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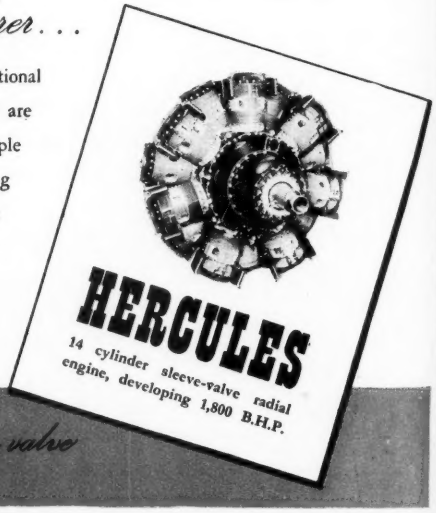

pioneered and developed the single sleeve-valve

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FLIGHT
and
AIRCRAFT ENGINEER

FIRST AERONAUTICAL WEEKLY IN THE WORLD : FOUNDED 1909

Editor
C. M. POULSEN

Managing Editor
G. GEOFFREY SMITH, M.B.E.

War Correspondent
JOHN YOXALL

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The Outlook

"Resting" on the Record

IT seems more than possible that last week's speed record attempt may be the final one to be made with airframes designed on present "conventional" lines. These runs, producing the magnificent average speed figure of 606 m.p.h., were all the more remarkable because the Meteor had not been originally designed for flying at very high Mach numbers and they formed the culmination of a series of trial-and-error tests after minor modifications had been made to the structure and control surfaces.

In short, a normal aircraft had been more lavishly powered than ever before, and the designers and test pilots simply set to work to find out how fast it could be flown while under full control at low level. The record runs provided the necessary official confirmation of a maximum permissible speed which had been known and aimed at during many months of hard work. That no insuperable compressibility effects or control difficulties had appeared at even lower speeds is a very great credit indeed to the design.

There is no doubt that, even with the power actually used, the figures could have been slightly improved if the teams had been prepared to wait indefinitely for more perfect weather conditions. It is even possible that, using all the available power, the speed could have been increased up to the point at which some temporarily incurable stability or control troubles might have been met. Perhaps it would have been of some prestige value (since the records are "homologated" in the metric system) to have reached the target of 1,000 km./hr.

But, all in all, we feel that the provisional decision to "rest" on the obtained figures is a wise one. We have shown what can be done, and it is doubtful whether any other aircraft at present flying can be quickly modified to give safe characteristics in low-level runs at any appreciably superior speeds.

The Next Attempt

THE next move will surely be to attack the record with an entirely new design based on the knowledge already gained, in flight and from wind-tunnel tests, of the various problems to be faced. Quite apart from the inevitable difficulties caused by shock-wave effects, the aircraft designers are by no means yet out of the wood where control problems are concerned.

Throughout the war the great majority of development and production flying troubles experienced with the faster aircraft have been concerned with aileron and other control difficulties. Following design efforts to keep down the stick-forces, test pilots have repeatedly run into difficulties with upfloat, over-balance, and critical changes of lateral trim at high diving speeds.

These difficulties will obviously increase as the speed level rises, and it is even likely that entirely new methods of control—at least in the rolling axis—will need to be devised if further progress is to be made. In its record-breaking form the Meteor was not a particularly handleable aircraft since, in order to reduce the danger of flutter and over-balance, all the servo-tabs had been locked.

Last February the Director of Technical Development, Mr. N. E. Rowe, remarked at Air Cdr. Banks' lecture to the R.Ae.S. that the difficulties ahead of designers could be considered not so much as a "compressibility wall" as a "boulder-strewn hill steepening rapidly from the plain," with the top always in sight but becoming progressively more difficult to reach.

The Meteor record runs can be considered to have

been among the last high-speed attempts among the "foothills" of compressibility. The next useful rise in speed will involve technicians and test pilots in more serious rock-climbing. High-speed wind-tunnels lose most of their real value at high Mach numbers as a result of their own "private" shock-wave, so most of this dangerous climbing will necessarily need to be done in full-scale testing of real aircraft. During the next few years test pilots will need all their enthusiasm and courage.

Part of the Cost

NOT long ago Washington issued a survey of the figures concerning the Allied bombing offensive against Germany. This survey stated that the Americans lost 79,265 men, while the R.A.F. lost 79,281. How the Americans arrived at this latter figure is not known; but it corresponds fairly closely to the losses in personnel by Bomber Command. The actual losses of Bomber Command amounted to 79,147, made up of 64,262 killed, wounded, missing and prisoners of war in air combat, and 518 as battle casualties on the ground. On active service, but not in battle, the Command lost 12,527 in the air and 1,315 on the ground. In addition, 525 died from natural causes. The American total of 79,265 obviously included those lost in fighter escorts and some other operations. We lost escort fighters, too, but they are not included in the figures of Bomber Command.

Perhaps the most astonishing figure in the British list is that of 8,088 killed in the air but not in battle; but in air combat we lost the appalling figure of 39,291 killed. Yet the British public has all along been assured that the blows struck at enemy war production by the bombing offensive were achieved more cheaply than they could have been achieved in any other way. There is no means of calculating how many more men the Army would have lost if German production had not been hit so hard as it was from the air, but that the figure would have been high there is little doubt.

One point may be gratefully conceded to the Americans, namely, their damaging attacks on German fighter factories. These did a very great deal to make easier the invasion of the Continent, for they helped to make possible the Allied supremacy in the air, which depended on the fighters. That gave freedom to the bombers, both those of Bomber Command and those of the 2nd Tactical Air Force, to hamstring the German efforts to check the advance of General Eisenhower's Armies.

In the years to come, it may be that those in a position to judge will argue whether the collapse of Germany was due more to the efforts of Bomber Command or to those of the Tactical Air Force.

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RECORD "CO-PILOTS": Mr. Eric S. Greenwood leaves the cockpit of the yellow Meteor after making his high-speed runs, and Group Capt. H. J. Wilson enters *Britannia* prior to his successful share in the record attempts. Shirt sleeves and utilitarian braces were the order of the short flying day. The record aircraft is seen above on one of its runs.

Britain Captures World's Speed Record

"Flight" copyright drawing by Rodmil

OFFICIALLY REPORTED SPEEDS

Group Capt. H. J. Wilson.

1st Run	...	604 m.p.h.
2nd ,,	...	608 ,,
3rd ,,	...	602 ,,
4th ,,	...	611 ,,

Average : 606 m.p.h.

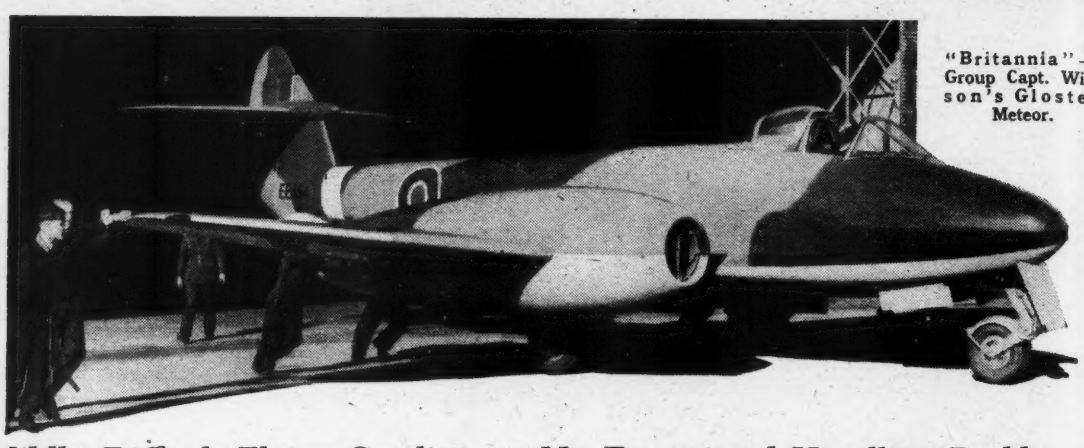
Mr. Eric S. Greenwood.

1st Run	...	599 m.p.h.
2nd ,,	...	608 ,,
3rd ,,	...	598 ,,
4th ,,	...	607 ,,

Average : 603 m.p.h.

Speed to be submitted to F.A.I. for homologation 976 km./h.

How the Record was Made



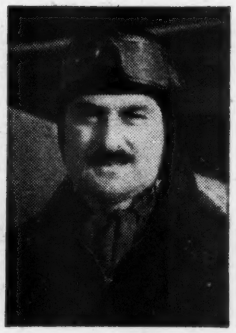
"Britannia"—Group Capt. Wilson's Gloster Meteor.

Mildly Difficult Flying Conditions : No Exceptional Handling Problems : A Natural Culmination of Trials

SO the world's air speed record stands, at least for the time being, at 606 m.p.h. On the cold and overcast morning of November 7, 1945, a series of routine high-speed tests and necessary preparations culminated in official timed runs, made without attendant pomp and circumstance, by the Gloster Meteors, over the Herne Bay course. There was nothing melodramatic or sensational about the affair from the point of view of the pilots, ground crew, or organisers; it was just a job of work.

Only to the comparatively few spectators was there anything very special about the moment when a light plume of smoke heralded the arrival of Group Capt. Wilson on his first run—a plume of smoke with, at its head, an incredibly fast and quite rock-steady morsel of man-made and man-controlled material travelling at 600 m.p.h. plus.

Group-Capt. H. J. Wilson, commanding officer of the Empire Test Pilots' School, Cranfield, the M.A.P. pilot for the trials

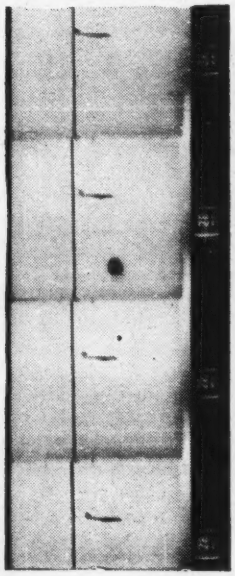


Mr. Eric S. Greenwood, chief test pilot of Gloster Aircraft, who made the development flights and flew the second Meteor.

For once, after weeks of waiting, the conditions were nearly right. The ideal would have been the practically impossible circumstance of a wind from the North-East just strong enough to maintain visibility at ten miles or more, yet not so strong as to produce bumps. A wind from this direction would have travelled over the North Sea and would, consequently, have been smooth except at very low levels.

As it was, the day's weather was just tolerable from the high-speed pilots' point of view. The visibility varied between seven and twelve miles on the different parts of the course, and a wind of about 12 m.p.h. blew across from East Anglia. This wind later backed and decreased, giving Mr. Greenwood, who made his runs an hour later than Group Capt. Wilson, very slightly better air conditions but, since slight industrial haze began to blow in from the West, rather less good visibility.

During the previous weeks many of the uninitiated had wondered why, when the weather appeared to be perfect, no attempts had been made on the record. Meteorological and other Meteors had made visually effective runs along the course and visibility was of the twenty-mile order. The fact was that on all these days the wind had been blowing from the land, producing rough air



(Left) One of the two timing cameras used, with Mr. Jefferies, of the R.A.E., an official timekeeper and an example of the film record obtained.

HOW THE RECORD WAS MADE

which, while tolerable at 400-450 m.p.h., would have been absolutely intolerable and even dangerous at the speeds at which the record runs would be made.

It was not only over the straight, high-speed section of the distorted figure-of-eight course that the air had to be smooth. Though the speed could be reduced to about 550 m.p.h. and height increased to about a thousand feet on the turns, these turns were each over land where the bumps would be at their worst, and even a slight reduction of speed and increase of height would not appreciably reduce the personal and mechanical discomforts experienced. On the timed run itself bumpless conditions were even more vital since at 600 m.p.h. the effects of rough air are shattering—not only making it impossible for the pilot, but overstressing the structure and even liable to produce premature compressibility effects.

Reduced Thrust

The figures obtained were, perhaps, a shade disappointing to the two pilots, who knew that in absolutely perfect conditions an average figure nearer to 610 m.p.h. might have been obtainable even with the limited thrust used. For structural and control reasons this thrust had been reduced, on the jet-units themselves, to 3,600 lb., which, it was estimated, would give the Meteor a maximum of 610 m.p.h.—beyond which speed Mr. Carter and his associates were not prepared to "guarantee" either the aircraft structure or the handling qualities. As it was, a technically interesting deformation of the fairings in the air intake was found in at least one of the aircraft. One of the reasons for the final decision to "call it a day" and not to attempt to improve on the figures was the natural desire of the technicians to make a thorough examination of each aircraft. When this examination has been completed, and further tests have been made, it is just possible, though not likely, that more trials will be made. At least another 400 lb. of thrust from each unit is still in reserve if such an attempt *is* made, but there does not seem much object in repeating the performance unless the speed can be put up very considerably.

In fact, the two Meteors appear to have handled surprisingly well at the speeds obtained. In very much earlier trials a nose-up compressibility effect had been noticed at somewhat lower speeds, but this had been cured by a very slight change of tailplane incidence. Presumably this tendency might reappear in due course if the speed was raised still further. The majority of aircraft develop a nose-down tendency at their maximum Mach number speeds, and the Meteor's characteristic is both unusual and "safe." It is a very great credit to the design that, at the average maximum speeds obtained (which give a Mach number of about 0.8), the aircraft should still be safely handleable at the low levels demanded by the F.A.I. rules. On all the runs each of the Meteors was absolutely steady.

The very slightly disappointing figures were primarily the result of the prevailing North-Westerly wind. The complete course forms a figure-of-eight, lying more or less East and West with the loops round North Foreland in the East and over the Isle of Sheppey in the West. To obtain the longest reasonable "straights" the pilots turned approximately 40 degrees off the timed track to the right after each run before making quiet left-hand 180-degree turns to bring the aircraft on to the speed line some eight miles or so from the actual timing points. With an 8-12 m.p.h. wind from the North-West each turn had to be "distorted" in order to return accurately to the straight. That over North Foreland could be slightly eased while that over Sheppey had to be proportionately tightened.

Drift Effects

The result was that both pilots had some slight difficulty in getting "lined up" comfortably when arriving from the west. More than once the fine smoke trail—all that could be seen of the aircraft in the distance—developed a momentary "kink" as the pilot found it necessary to make a slight S-turn to get on to course. And at that speed, with sealed tabs, turns cannot be made quickly. The rate of turn had to be kept below an absolute maximum of 3 G. if speed was not to be lost and the turns were being made "visually," so, with the reduced visibility at the Western end of the course and the necessary tightening of the turn to allow for drift, it must have been quite difficult for the pilots when entering the West-East run. In fact, we believe, Group Capt. Wilson very nearly decided to abandon one of his runs.

The average drift of 8 m.p.h. or so also made the "straight" flying something of a problem, and each pilot tended to put on bank as soon as he had left the measured part of the course while flying westwards in order to avoid

PERSONALITIES BEHIND THE POWER : Air Commodore F. Whittle, the pioneer of Turbine Jet development, Dr. S. G. Hooker (left), chief engineer of the Rolls-Royce turbine engine section, and Mr. J. P. Herriot, his assistant.

WORLD'S AIR SPEED RECORDS

Year.	Pilot and Country.	Km./hr.	Aircraft.
1906	Santos-Dumont (France)	41.3	Santos-Dumont.
1909	Tissandier (France)	54.81	Wright.
1910	Leon Morane (France)	106.51	Bleriot.
1911	Ed. Nieuport (France)	130.06	Nieuport.
1912	Jules Vedrines (U.S.A.)	174.10	Deperdussin.
1913	Maurice Prevost (France)	203.85	Deperdussin.
1920	Sadi-Lecointe (France)	313.04	Nieuport-Delage.
1921	Sadi-Lecointe (France)	330.28	Nieuport-Delage.
1922	B. G. Mitchell (U.S.A.)	358.84	Curtiss.
1923	Lt. Williams (U.S.A.)	429.03	Curtiss-Racer.
1924	Adj. Bonnet (France)	448.17	S.I.M.B.
1927	De Bernardi (Italy)	479.29	Macchi M.52.
1928	De Bernardi (Italy)	512.78	Macchi M.52.
1929	Orlebar (Gt. Britain)	575.70	Supermarine S6.
1931	Stainforth (Gt. Britain)	655.00	Supermarine S6B.
1933	Agello (Italy)	682.078	Macchi C.72.
1934	Agello (Italy)	709.2	Macchi-Castoldi M.72.
1939	Dieterle (German)	746.41	Heinkel He 112.
1939	Fritz Wendel (German)	755.138	Messerschmitt Me 109.
1945	**Group Capt. Wilson (Gt. Britain)**	**976.00**	**Meteor IV.**

HOW THE RECORD WAS MADE

the inner balloon of the two on the pier at Herne Bay where an Aldis searchlight provided the necessary aiming point in both directions.

The combined visual and aural impression of sheer speed was undoubtedly greatest for the watchers on this pier since the Meteors arrived more or less silently while "growing" in front of a smudge of smoke, passed overhead with a thunder-clap of noise, to disappear again behind the smudge. From the timing-box position on the cliff the impression was largely one of faultless stability, both Meteors passing, against the dull grey of the sea, as if on rails, leaving an absolute straight pencil of smoke along the course, while the noise of the passage, which could only be described as a "whistling rustle," arrived later. An interesting illusion was that, because of its bright yellow finish, Mr. Greenwood's Meteor appeared to be making the faster of the two series of runs.

To the ordinary person the fact that the average speeds were more or less reversed between the printing of evening and morning newspapers must have seemed more than odd and to have suggested a somewhat happy-go-lucky system of timing. In fact the figures provisionally given were known to be of the "egg-timer" variety, and the officials had always made it absolutely clear that these figures were liable to an error of anything up to 20 m.p.h., obtained as they were by "snap" human-error methods.

As a matter of interest, those provisional times produced by the experimental and quite unofficial Radar method of timing were much more nearly correct. Unfortunately, the transmitter suffered a momentary fault during Group Capt. Wilson's run, and Messrs. Popham and Stillwell, of the R.A.E. only managed to obtain those for Mr. Greenwood. But these were "good." The extraordinary "error" made during one of the previous day's practice runs was, in fact, one of policy rather than of mathematics. But that is another story.

Variations

The "alternating" difference in the finally corrected figures is easy to explain. These were, for Group Capt. Wilson, 604, 608, 602 and 611 m.p.h. respectively, giving an all-in average of 606 m.p.h. The slower times were for the East-West runs, with a slight head-wind component, while the higher figures were for those in the reverse direction. Mr. Greenwood's times—599, 608, 598 and 607 m.p.h. (average 603 m.p.h.)—were similarly affected. A little addition and subtraction shows that the average wind component in relation to the course was 3.2 m.p.h. while Group Capt. Wilson was flying and 4.5 m.p.h. during Mr. Greenwood's runs—showing how the wind had backed during the interval. Mr. Greenwood had, in fact, been due to take off almost as soon as the first Meteor had landed, but a minor *faux pas* had been made with a starter accumulator switch during the inevitable excitement. He climbed in and out four times and, though he didn't show it, the series of incidents must have been very wearing to the nerves of a pilot in such circumstances.

Brief indications have already been given of the comparatively minor modifications made to the record aircraft. The various problems were discussed, and the Meteor and its power units were described in *Flight* of October 25th. The major difference, apart from the installation of Derwent V units, lay in the lengthening of the power nacelle to deal with certain compressibility effects. The wing spars and fuselage had been stiffened and modifications made to control runs and mass balances. From exterior examination the only features which can, by any stretch of imagination, be called "special" were the smooth finish, the general cleaning up and necessary control modifications to prevent any possibility of flutter or over-balance. All the servo-tab systems were made inoperative, leaving normally controllable tabs for the rudder and elevator. The latter had also been "corded" on each side of the trailing edge in rather the same manner as in the case of the rudder of the standard aircraft. The steps and foot holes had been removed and the cockpit had been sealed.

Simplicity

From the pilot's point of view the "inside" is almost standard and has all the control simplicity of jet-propelled aircraft. On superficial examination it was seen that the jet pipe temperature gauges, forming a single instrument, had been shifted to a position on the blind-flying panel so that the figures could be more easily seen, and just above the distant-reading compass on the left, there was, at least on one aircraft, a simple form of G-meter or accelerometer. Since all the flying was done visually and the maximum speed had, so to speak, been pre-set by a limitation of thrust in the power units themselves it is doubtful whether either of the pilots took much more than one quick glance inside during the whole of the sixteen minutes during which he was airborne.

At one period there had been some slight doubt about the general fuel situation, since the total time in the air could not be accurately calculated and the consumption might vary considerably according to the use of the throttles between the straights. In fact, each aircraft used about 260 gallons during the 16 minutes, leaving a reserve of approximately 100 gallons after landing. Though the consumption works out at about 975 gallons an hour, this is not excessive when the thrust obtained is measured in horse-power. At its permitted maximum each Meteor was, in effect, powered with a pair of 5,760 h.p. engines. Taking the total distance of the two figures-of-eight as 132 miles and adding 12 miles "for luck" and speed-reducing circuits (three in number—the record Meteors have no air-brakes), the average speed for the whole outing of sixteen minutes works out at 540 m.p.h.!

AIDS TO SPEED

The following were among the firms whose equipment contributed to the success of the Rolls-Royce Derwent-engined Gloster Meteors :—

ROTOL LTD.—Auxiliary gear boxes for accessory drives.

SKEFKO BALL BEARING CO., LTD.—Majority of bearings in aircraft and engines.

DOWTY EQUIPMENT, LTD.—Levered suspension tricycle undercarriage and live-line hydraulic system.

WM. JESSOP AND SONS LTD.—"G.18B" austenitic steel for turbine rotors.

JOSEPH LUCAS LTD.—Combustion equipment, fuel systems and electrical equipment.

K.L.G. SPARKING PLUGS, LTD.—Igniter plugs and thermo-couples.

METROPOLITAN-VICKERS ELECTRIC CO., LTD.—Infra-red paint-drying equipment.

SIMMONDS AEROCESSORIES, LTD.—Locknuts; electric fuel-contents gauges

REPAIR RETROSPECT

THAT more than 80,000 aircraft were repaired during the war, of which three out of every five were produced by the civilian repair contractors, was disclosed at a dinner given in London last Thursday by the Aircraft Repair Contractors of the Civilian Repair Organisation, R.A.F. It was further stated that, in the busiest quarter, no less than £100,000 per day was paid to civilian repair contractors. This figure represented approximately one-third of what would have been the cost of the same aircraft new, but Mr. Pickles, Director of Contracts, pointed out that it did not include free issues.

All the speakers (there were nine of them!) stressed the good relationship that had existed between the repair contractors and the various Directorates. Troubles there had been, and differences of opinion, but the job had been done.

DEVASTATED GERMANY IN PICTURES

THOSE members of Bomber and other Commands who have been flown round the devastated areas of Germany on sight-seeing tours have one sort of mental picture of the chaos. Those who have seen it from the ground have an altogether different one, more circumscribed, perhaps, but intensified by details and the presence of the cellar-dwelling inhabitants.

This latter picture is presented more vividly than any photographs can do by a series of water-colours on exhibition until November 30th at Foyle's Gallery, Charing Cross Road, London. They are the work of a South African official war artist, Capt. Geoffrey Moss—who, incidentally, was dropped by parachute on several occasions to record the partisan war in Northern Italy. The exhibition (admission by catalogue at 1s. 3d.) is in aid of the R.A.F. Benevolent Fund.

Revelations at Farnborough

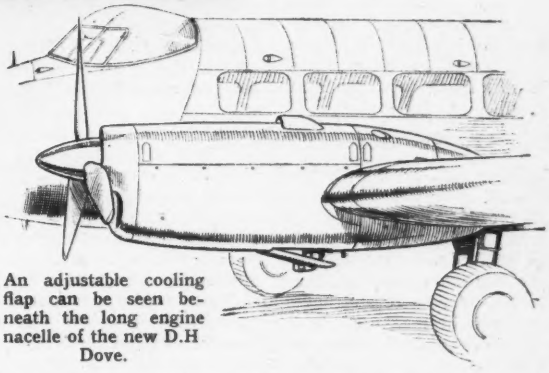
Part II. Remainder of Exhibits at the Show : The Martin-Baker Fighter : German Oddities

The Avro Tudor, in all its sleek beauty, on the tarmac ready for visitors' inspection.

(*Concluded from page* 506)

IN last week's issue of *Flight* the big show of British and enemy aircraft, engines and accessories staged by M.A.P. and the R.A.E. at Farnborough, was described in detail so far as space permitted, and it is now possible to deal with the remainder of the exhibits.

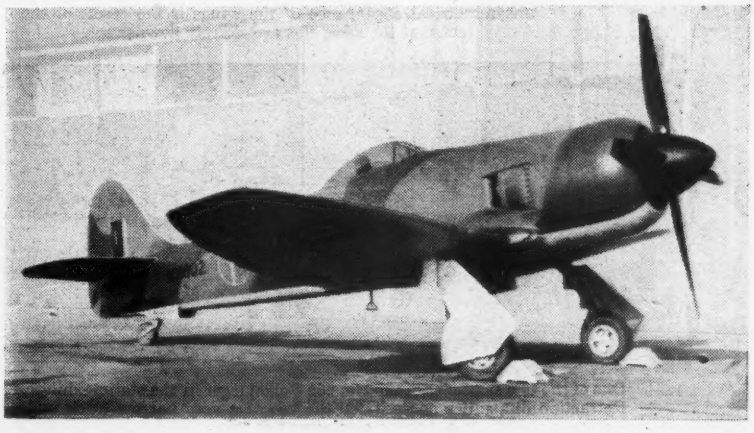
A more than ingenious single-seat fighter which unfortunately did not go into production during the war, the newest Martin-Baker F-18/39, was seen for the first time at the exhibition. One critical onlooker described its general appearance as "a cross between a Mustang and a V2." In its latest form it is Griffon-powered, with Rotol contra-rotating airscrews, and it was, incidentally, flown by Mr. Greensted, the chief test pilot of Rotols, who has done, we hear, much of the recent development work on the type. On this occasion he was, perhaps, lucky when the sliding canopy jettisoned itself, while being opened during the approach, without seriously damaging the tail surfaces. The incident must have been a very uncomfortable one for the pilot, and the consequent airflow change probably made the elevator control not a little odd while holding off. Accessibility and simplicity are the two outstanding features of the Martin-Baker. The fuselage, for instance, is of tubular construction, covered almost entirely by quickly removable panels. The relation between the engine mounting and the cockpit position is such that the forward view is much better than average for the type, while the leading edge is sufficiently far aft to give the pilot an additional and very useful field of view forward and downward.

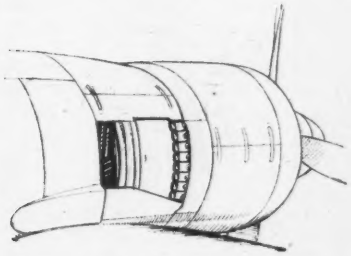


An adjustable cooling flap can be seen beneath the long engine nacelle of the new D.H Dove.

The Supermarine Spiteful XIV, described a fortnight ago, was demonstrated shortly and succinctly by Flt. Lt. Jeffrey Quill, Supermarine's chief test pilot.

Before the impressive Shetland finale, spectators had a chance of watching the somewhat frightening performance of two German jet aircraft—the Heinkel 162 *Volksjaeger* and the Messerschmitt 262 H4. Curiously enough, though lethal in appearance, the tiny 162, with a span of only 23½ft., is, one gathers, quite a nice aircraft. It arrived at the far end of the very long runway with assistants at the wing tips and ran very nearly the whole length before becoming unsatisfactorily airborne. Its take-off, of course, would have been very much better with Wasag or other rocket





The Hawker Fury and a detail sketch of its Centaurus cowling and air efflux louvres.

REVELATIONS AT FARNBOROUGH

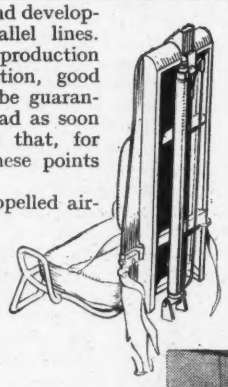
assistance. With its single-jet unit mounted above the fuselage the Germans gave the 1062 a maximum of 522 m.p.h. at 20,000ft., with a ceiling of nearly 40,000. Apparently the prototype was produced in about three months and large numbers were on order. It has a pilot-ejection device and was flown (and rolled) by Flt. Lt. Foster of the R.A.E.

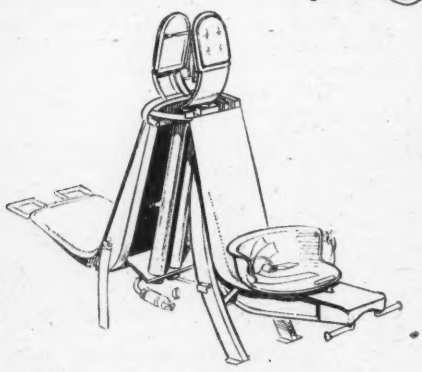
By contrast, the twin-jet Me 262, flown by Sqn. Ldr. Martindale, was almost conventional in appearance, and the pilot was seemingly very happy about it since his arrival after the demonstration was almost dashing for such a type. Evidently it has very good aileron control even at high speeds, and the demonstrated rate of roll was almost "flick" in its violence. The German figures, which have been checked and partially approved, give a maximum speed of 527 m.p.h. at 20,000ft. and, like the 162, a ceiling of nearly 40,000ft. The endurance is somewhat better at 95 minutes for cruising at operational height. The engines are Jumo 004 B-4s, as opposed to the single BMW 003E of the 162. The Messerschmitt was, of course, the first German jet-propelled aircraft to be used operationally, appearing at about the same time as the rocket-propelled Me 163. Both the demonstrated German jets have a somewhat shocking stalling speed—in appearance around the 120 m.p.h. mark, with an approach speed of 150 m.p.h.

The German Exhibits

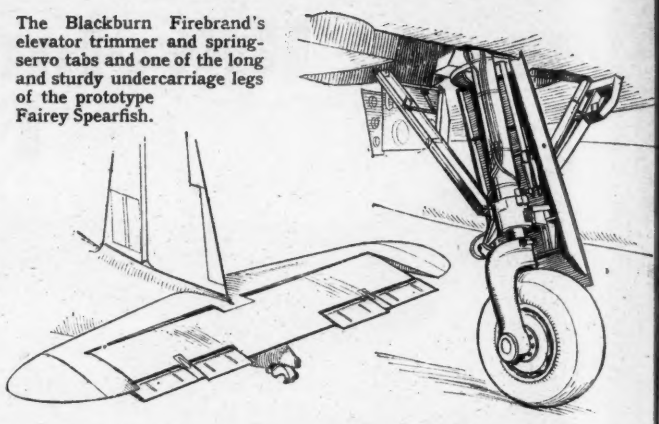
The casually knowledgeable visitor to the R.A.E. Exhibition must have been surprised at the variety and ingenuity of the German aircraft to be seen. Although the very diversity indicated a tendency to panic development, there is not much doubt that, had the European war continued until 1946, there would have been a very sombre struggle for air supremacy, particularly in the fighter sphere. The potentialities of jet units as a direct method of fighter propulsion had been obvious for some time to both protagonists, and development had followed largely parallel lines. But, whereas we had held our production plans until reasonable consumption, good engine life and reliability could be guaranteed, the Germans had gone ahead as soon as possible with the knowledge that, for purely local defence, none of these points were of vital importance.

The first operational rocket-propelled aircraft in the world, the Me 163, was powered by the Walter HWK 509 unit weighing only 365 lb. and developing 3,300 lb.

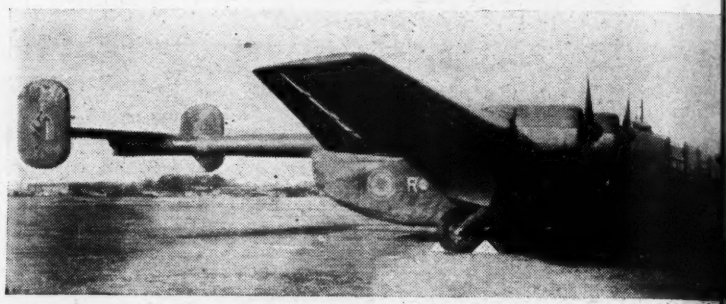




Two types of German pilot-ejector seats.

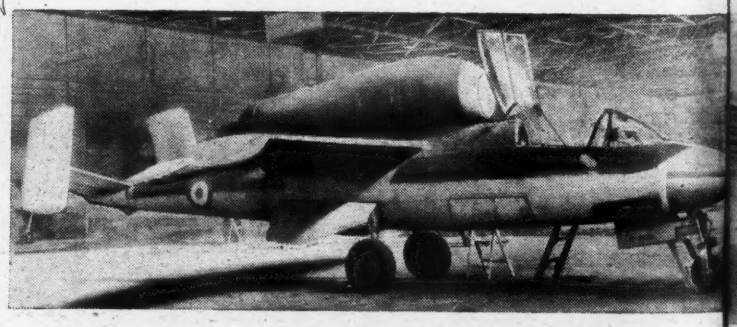


The Blackburn Firebrand's elevator trimmer and spring-servo tabs and one of the long and sturdy undercarriage legs of the prototype Fairey Spearfish.

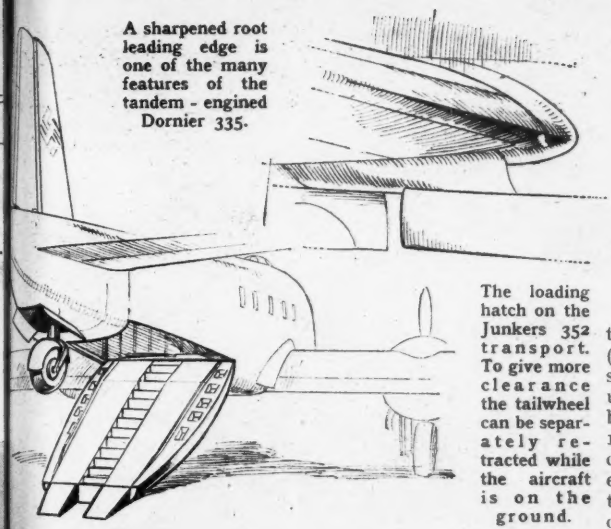


The German Arado 232 with its 23 landing wheels has a distinctly centipedal look about it

The Heinkel 162 single-jet fighter in the air. The curiously unsymmetrical appearance of the wings is the result of the fact that the wing tips are sharply downswept.

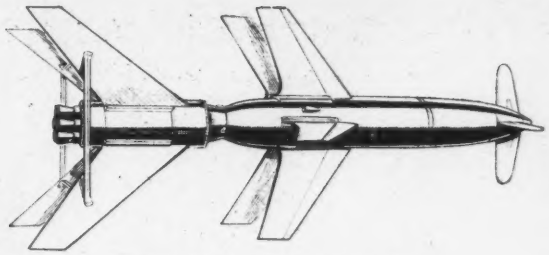


One of the two examples of the He. 162 Volksjaeger in the static exhibition. Retraction difficulties necessitated the use of a very narrow-track undercarriage.

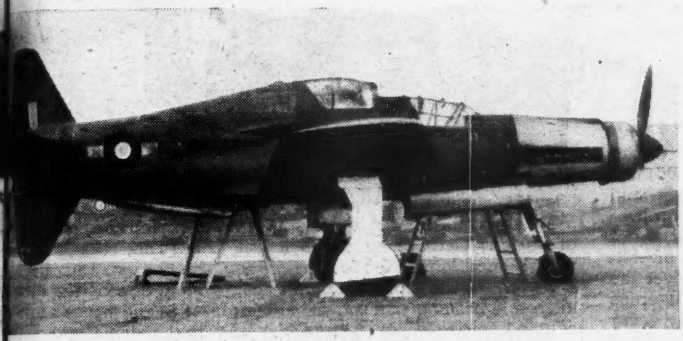


A sharpened root leading edge is one of the many features of the tandem - engined Dornier 335.

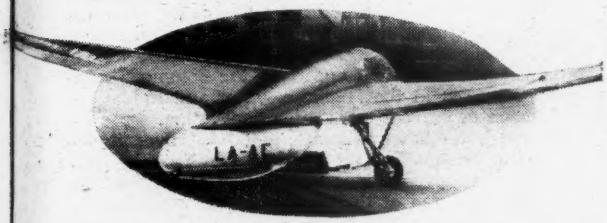
The loading hatch on the Junkers 352 transport. To give more clearance the tailwheel can be separately retracted while the aircraft is on the ground.



Rheintochter I, a winged flak rocket.



The tandem-engined Dornier 335 in trainer form. Though never used operationally, this was probably the fastest German airscrew-driven machine.



Ingenious in the extrême, the tailless Horten IV sailplane has pedal-operated spoilers in place of rudders. The pilot lies prone.

The Me 262 undercarriage tyres smoking as the wheels endeavour to accelerate to take the high landing speed.

thrust at sea level. The two fuels, hydrogen peroxide (*T-stoff*) and hydrazine hydrate (*C-stoff*) are carried in separate tanks and delivered to the combustion chamber under pressure by two centrifugal pumps driven by a turbine. At full thrust the rate of consumption is more than 1,000 lb./min. Fuel accounted for approximately 50 per cent. of the normal flying weight of 9,500 lb. for the aircraft equipped with two 30 mm. cannon. Duration at full thrust was thus about 4½ min. but a climb to 30,000ft. took only 2.6 min. and the motor could be throttled down for level flight. Throttling reduces the efficiency, and accordingly the unit illustrated was developed for the Me 163c. This has a main combustion chamber giving a thrust of 3,740 lb. and an auxiliary chamber giving 660 lb. thrust for cruising. Both could be used simultaneously for short bursts at 4,400 lb. thrust.

The Me 163c had a take-off weight of 11,280 lb., an endurance under power of 12 min. and was credited with a speed of 590 m.p.h. between altitudes of 13,000 and 39,000ft.

Apart from the He 162 and the Me 262 and the Walter rocket unit used in the Me 163 fighter, there were a number of other interesting German designs and detailed exhibits to be seen at Farnborough.

Most unusual of the airscrew-propelled aircraft to be seen was the tandem-engined Dornier 335 which, though never used operationally, was credited with a maximum speed of 472 m.p.h. at 21,000ft. The two D.B. 603 engines are mounted one in the nose and one aft of the centre section, and the forward airscrew is capable of pitch-reversal. Obviously, since there is an airscrew in the rear, landings would need to be of the "flung-on" type, and it would not be possible to lose speed before touching by increasing the landing incidence in the modern tricycle manner. The example shown at Farnborough was the two-seater trainer version.

High-altitude Development

The battle for altitude was exemplified by the Blohm and Voss 155, with a steel pressure cabin forming part of the actual structure. The D.B. 603 engine in this aircraft has a three-stage supercharger, two of the "stages" being exhaust-driven turbos and the other an engine-driven impeller. Not unnaturally, a very large intercooler is fitted. The claimed maximum is 431 m.p.h. at 55,000ft.

Both the well-known Fw 190 and lesser-known Fw Ta 152 were shown, and the former was also to be seen as part of the Fw-Ju 88 combination. The 152 was reputed to have a top speed of 425 m.p.h. at 35,000ft. To combat the Mosquito raids, the Heinkel 219, with its ejector-type seats and elaborate radar equipment, was almost Germany's last word in night fighters, and was made in large numbers. The maximum speed, at 21,000ft., was 382 m.p.h. Comparable with this, and appearing at about the same time,

REVELATIONS AT FARNBOROUGH

was the Me 410. This was developed from the 110 and 210, and was credited with a maximum speed of 395 m.p.h. at 22,000ft., and a range of 1,040 miles.

Three typical German military transports were shown—the Fw 200 (known in peacetime as a Condor), the old Ju 52, and its later development, the Ju 352. The latter was interesting in that, while being conventionally "three-pointed" on the ground, it is fitted with a rear-entry loading ramp. When necessary to increase entry clearance, the tail-wheel can be separately retracted.

Another jet-propelled aircraft to be seen was Arado 234 B-2 with two Jumo 004 B-4 gas turbines. Check tests with this aircraft at Farnborough gave slightly lower figures than those officially provided. In any case, the maximum for the type was somewhat low—490 m.p.h. at 30,000ft.—with a service ceiling of 40,000ft. The Arado, however, was designed for high-speed bomb attack and carried a projectile load of 2,000 lb. A parachute is used as a landing drag-brake and this was shown separately. More than two hundred of these aircraft were produced.

Undoubtedly the last word in death-or-glory fighters was the rocket-propelled Me 163 B, an example of which was shown in the hangar with its Walter propulsion unit. This aircraft (if it can so be described) had an endurance of only 230 seconds at maximum thrust, and an estimated range, after climb, of 22 miles at 495 m.p.h.—the actual maximum speed being 558 m.p.h. One is not surprised that the Me. pilots' death roll was high or that the surviving pilots were reputed to have mutinied over the question of its continued use. Not only was it dangerous as a flying machine, but accidents could very easily occur even while it was being fuelled, since the two mixtures used tended to explode on their own if brought into contact in the open air. The method used, for safety reasons, was to blast off by air pressure any spilt remains of one chemical before adding another.

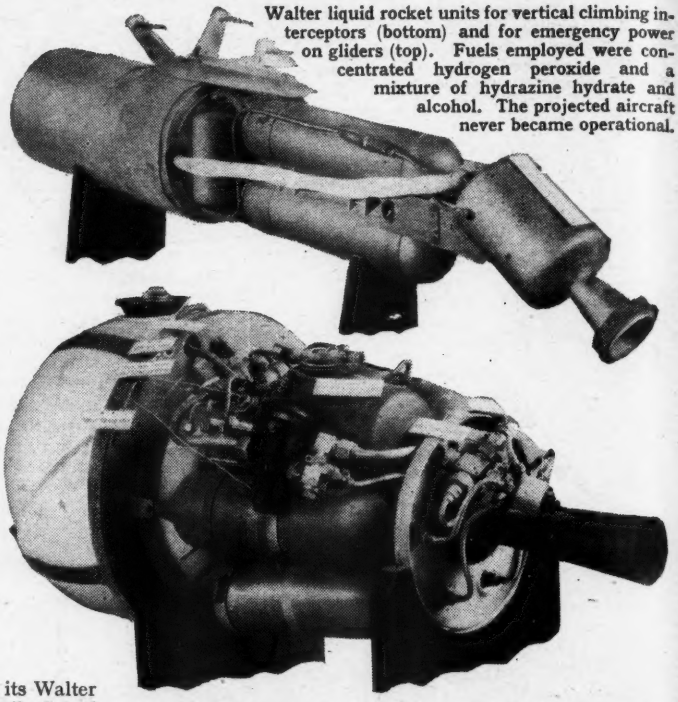
Motorless

Not unnaturally, the Me 163 would very easily exceed its safe Mach number—which was not, in fact, exceptionally high, control being lost at a speed a little below 600 m.p.h. In this connection it is interesting to recall that a Spitfire has actually reached 620 m.p.h.—92 per cent. of the speed of sound at 30,000ft.—while still under control.

A somewhat more peaceful impression was given by the two sailplanes to be seen. One was the Olympia, which is being made in this country by Chilton Aircraft, and the other the very interesting Horten IV. This is a high-performance tailless design in which the pilot lies, suitably if uncomfortably supported, in the prone position. Wing tip spoilers, which are pedal operated in the usual rudder sense, act individually as drag rudders or, when used together, as spoilers pure and simple. The control surfaces are sub-divided with intergearing to provide the necessary change in lift along the wing. One of the Gyro kites used by the U-boats was also shown in this section.

Those civilians and others among the visitors who suffered the earlier blitzes and the later *Vergeltungen* I and II raids must have enjoyed the exhibits of various missiles—including a complete flying bomb on its launching catapult—and all so very harmless. The V1 exhibit included a show of the various internals in the impulse reaction engine, and a working model of its automatic pilot. The A4 rocket, known generally as the V2, could also be seen in its various component parts.

The German technical people were evidently hard at work on thermal de-icing equipment for leading edges and various other parts of aircraft, while in the section dealing with life-saving dinghies and equipment, British items were shown by way of comparison.



Walter liquid rocket units for vertical climbing interceptors (bottom) and for emergency power on gliders (top). Fuels employed were concentrated hydrogen peroxide and a mixture of hydrazine hydrate and alcohol. The projected aircraft never became operational.

Most extraordinarily thorough were the exploded exhibits of various German types, including the Ju 88, the previously mentioned He 162, the Me 109, the Fw 190, and the BV 155. In the Junkers exhibit their system of centrifugal aileron lightening was shown. Pendulums in the wings are coupled to the ailerons in such a way that when the aircraft rolls the forces tend to reduce the amount of effort needed for recovery by the pilot. Junkers were also probably the first German firm to use spring tabs; this, applied to the rudder, could also be seen. An interesting aileron tab system was shown in the BV 155. In this, each aileron is in two portions, the outer portion being directly controlled, while the inner portion is controlled solely by a tab, which is directly coupled to the column. An oil damper is used in the He 177 elevator and rudder spring tab system to prevent too sudden application.

Although we have only attempted to cover the more interesting features of the German static exhibition, we have tried to give an idea of the very considerable scope of the display and of the amount of work put into it by R.A.E. personnel. At the same time the various departments of the Establishment itself were open to the "official" public. They could see, for instance, a high-altitude engine test-bed, a sand-tunnel for air cleaner tests, an R.A.E. injection-type carburettor, various vibration testing systems, small-scale and full-scale wind tunnels, a high-speed tunnel for studying for compressibility effects, and model "ditching" pond for the study of the behaviour of landplanes in such unnatural surroundings.

MR. RELF'S NEW POST

AFTER considerable delay the name of the Principal of the new College of Aeronautics has been announced. Mr. E. F. Relf will be the man to occupy this important post.

Mr. Relf is known to almost everyone for his good work as superintendent of the Aerodynamics Department of the National Physical Laboratory, a post which he has held since 1925. He was educated at the Royal College of Science, and joined the N.P.L. in 1912. He possesses to a remarkable degree the gift, very rare in men with advanced knowledge of a particular subject, of being able to explain even complicated problems in a simple way, and his technical knowledge extends to many subjects beyond the science of aeronautics.

HERE AND THERE

Mr. Coverley Resigns

MR. R. H. COVERLEY, C.B.E., has relinquished his position as controller of Rotol, Ltd. He was appointed to this post in 1939, having previously been with Rolls-Royce, Ltd., for some 30 years.

Turbine Jets for Air Transport

A FORTNIGHT ago Mr. Geoffrey Smith gave a talk on the B.B.C. General Overseas Services discussing the impending jet plane record, and followed it up last week-end with some deductions and a discussion of the possibilities of turbine-jet propulsion for civil air transport.

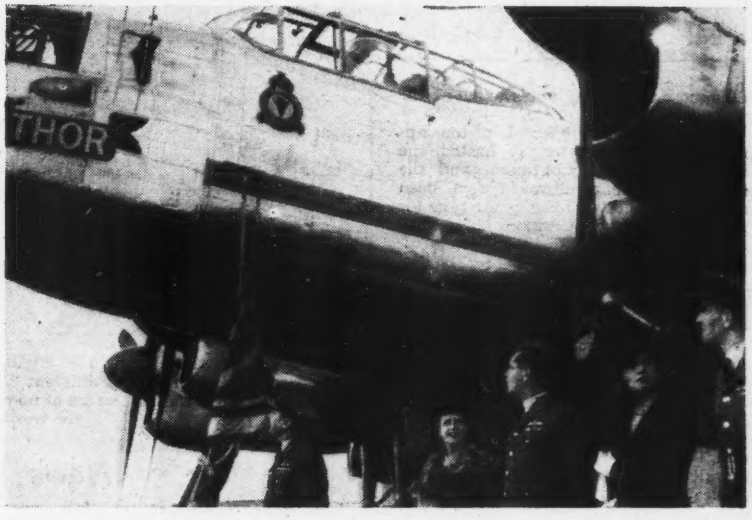
Model Aircraft Winners

A TEAM of five model aircraft builders from the Midland region has won the Aero Modellers' Trophy in a competition, open to the whole country, organised by the National Association of Spotters.

The five come from Fort Dunlop tyre production department, the machine shop, the offices, and the new factory at Speke.

What France Wants

IN the detailed list of her requirements in aircraft and other German war material submitted to the Allied Control Commission in Berlin, France has asked for 50 jet-propelled fighter-bombers for technical study, 350 transport aircraft, 2,800 trainers, 2,000 gliders, 5,000 to 6,000 aircraft engines, and 300 aircraft tyres. Instruments, radio and anti-aircraft equipment are also listed.



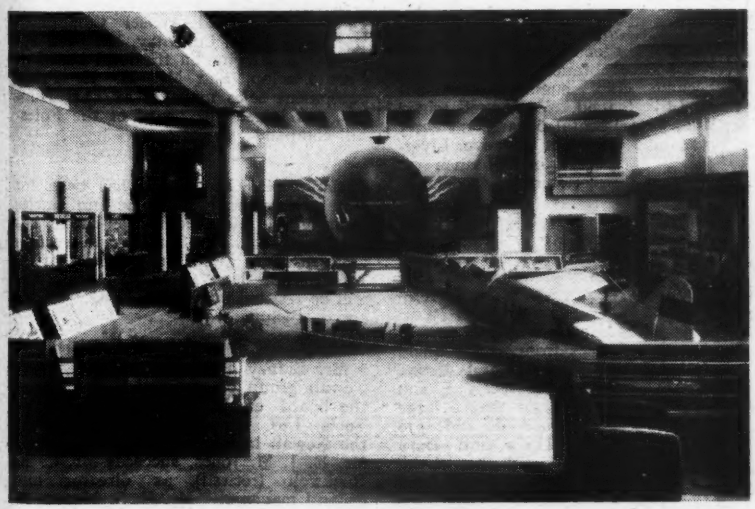
CHRISTENING PARTY: A Lancaster from the Empire Air Armament School at Manby, Lincs., was christened *Thor* by the wife of the school's Commandant (with real champagne, too!) before setting out on a six-weeks' tour of the Middle East, S. Rhodesia and S. Africa. Left to right are Air Comdre. C. W Busk (Commandant), Mrs. Busk, Wing Cdr. M. H. de L. Everest, and Mrs. Everest.

Acceleration Promised

IN reply to a question from Wing Cdr. R. Robinson (Con., Blackpool South) in the House last week, Mr. Wilmot, Minister of Supply, said that 56 civil aircraft of eight different types had been produced in Britain from January 1st to October 31st this year.

"How are we going to lead the world in civil aviation with ten months' production of 56 aircraft?" Wing Cdr. Robinson wanted to know.

"By a very greatly accelerated programme now that the war is over," replied Mr. Wilmot.



INVITING THE TURKS to buy British goods is the laudable object of the mobile exhibition now visiting important centres in Turkey. It has been arranged by the British Embassy at Instanbul, and a Miles Magister is a notable exhibit.

Flying Doctor's Fate

DR. VALENTINE ALEXANDER STOOKES, who in 1936 bought an Aeronca C3 floatplane to facilitate his visits to patients on his widely scattered "round" in British North Borneo, is now known to have been murdered by the Japs last July.

The doctor, who qualified at Edinburgh and St. Andrews, postponed his medical studies during the 1914-18 war to fly with the R.F.C. and won the Military Cross.

Budget Blues

THOUGH the man with a small wage and a large family is naturally cheered by Mr. Dalton's interim Budget, the Austin Motor Co. is not so enthusiastic.

In a statement issued by their vice-chairman, Mr. L. P. Lord, it is announced that, because of the Budget, the outlook for the sale of motor cars (home and export) does not warrant the acquisition of the shadow aircraft factory at Cofton Hackett which the company managed for M.A.P. during the war.

The firm has therefore decided to forgo the three months' option on the factory so as not to hold up any other concern which may want it.

A Helpful Gesture

INFORMATION on the German wartime developments in pistons and piston-rings which was gathered by Mr. C. F. Russell and Mr. E. B. Graham, general manager and director, and technical director respectively of Specialloid, Ltd., during their tour of Germany, is being made available to any member of the trade who is interested in this subject.

During their tour, Messrs. Russell and Graham covered over 3,000 miles in three weeks and visited 14 factories, and they were among the first British engineers to undertake such a mission after hostilities ceased.

The information now offered to anyone who wants it is a summary of Mr. Rus-

HERE AND THERE

sell's more interesting notes taken at the various plants.

Incidentally, the pressed piston appears to have very largely ousted the cast piston on the Continent, and the main developments observed have been in the manufacture of the newer type for practically every German high-duty engine.

G.A. Activities

RECEIPT from the M.A.P. of a design contract for a large four-engined freight-carrying aircraft was one of the things mentioned by Sir Maurice Bonham Carter, chairman of General Aircraft, Ltd., in his statement at the company's annual general meeting at Feltham yesterday. "If the project is proceeded with," said Sir Maurice, "this type of aircraft will have both military and civil applications."

He also referred to the production of the powered version of the Hamilcar during 1944, and mentioned that the company had a full programme of development work, including a series of tailless aircraft, the first of which was now being tested by the R.A.F. Two other tailless types were in "an advanced stage of completion."

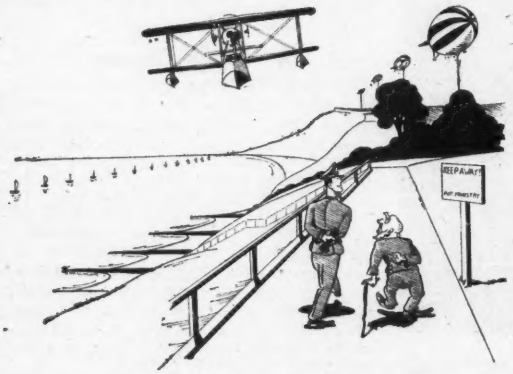
Multum in Parvo

RESTRICTED as they are in terms of square feet in their London showrooms at Queen's House, Kingsway, the English Electric Co. have contrived to stage a most effective "War Activities" exhibition which opens to the public on Monday next, November 19th.

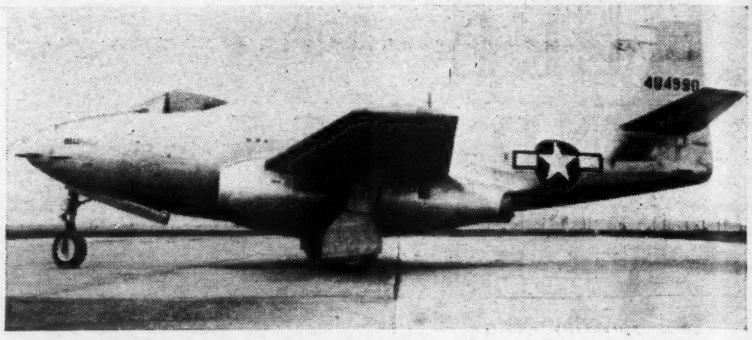
As Sir George Nelson, their chairman and managing director, said at the Press preview, it would need a space as big as Hyde Park to stage a complete life-size range of all their war products, but the present exhibition was designed to give a general idea of the wide extent of the firm's war work.

The change from war to peace, Sir George added, must be even quicker than from peace to war, and there was no industry that brought greater amenities to man (and woman, in the home) than the electrical industry.

Circumscribed though it inevitably is, this exhibition compactly illustrates the claim of E.E.C.—that it played a valuable part in every theatre and every branch of the 1939-45 World War.



"No grandad, that is *not* Group Capt. Wilson trying again."



XP-83. This is the new twin jet-engined Bell fighter built for the U.S.A.A.F. and it is described as "radically different" from the P-59 Airacomet. Up to the time of going to press we have heard of no claim that this latest jet-propelled fighter is the world's fastest!

News in Brief

TO-MORROW, November 16th, our associated journal, *The Autocar*, publishes its Jubilee Number to make 50 years of recording motoring progress. A comprehensive review of motor racing is among the special features.

* * *

The first of four Superfortresses which recently flew from Hokkaido, Japan, to Washington, completed the 6,553 miles non-stop in 27 hr. 29 min., landing at 12.38 a.m. The three others arrived at 1.42, 1.43, and 2.13 a.m. respectively. E.T.A. was midnight. A previous attempt failed to produce a non-stop flight, all having to land at Chicago through fuel shortage.

* * *

A new service depot for Northern Ireland has been opened by Specialloid, Ltd., at 32, Linen Hall Street, Belfast, under the management of Mr. F. W. Callaway, the district engineer. (Tel.: Belfast 27906.)

* * *

The London office of David Brown & Sons (Huddersfield), Ltd., has been removed to Haymont House, 3, Panton Street, Haymarket, S.W.1 (Tel.: Whitehall 5061-3.

* * *

Mr. J. W. P. Angell, who since March, 1940, was manager of the Miles Aircraft Liverpool Road branch, has left there to become chief engineer of Kent Alloys, Ltd., Strood. Mr. Angell joined the Miles experimental department early in 1939, and a year later took over Liverpool Road branch in succession to Mr. Tuson.

* * *

The 578 Burn Association are holding a reunion dinner at the Londesborough Hotel, Selby, Yorks, on December 29 at 6.30 p.m. Already tentative acceptances from as far afield as Karachi and Poona have been received, and it is hoped that a large attendance of old 578 Squadron and Burn friends will be there. Tickets are 6s. each from the Treasurer, Sqn. Ldr. Elsworth, 73, St. John's Avenue, Bridlington. Any further particulars required can be obtained from the secretary, F/O. B. R. Taylor, Keverstone, Dinas Powis, Glamorgan.

* * *

Twenty-seven French Air Force and Naval pilots who passed out at No. 7 Service Flying Training School, R.A.F., Westwood, Peterborough, were recently presented with wings and certificates at the school by Gen. de Vitrolles.

* * *

Leicester branch of the Royal Aeronautical Society is to hear a talk on "Radar in Air Warfare" by Mr. J. F. W. Mercer on Friday, November 23rd, and one on "Post-war Light Aircraft Design" by Mr. D. L. Brown, of Miles Aircraft, Ltd., on Wednesday, December 12th. Both meetings will be held at 7.30 p.m. at Leicester Technical College.

* * *

Flt. Lt. L. N. S. Dunkerton has been appointed manager of Cecil Kay Aircraft, Ltd., Birmingham, the Midland distributors for the Auster, on his release from the R.A.F.

* * *

Mr. J. Wright, general manager of the Dunlop Rim and Wheel Company's works, Foleshill, Coventry, has been appointed a director on the local board at Fort Dunlop, and Mr. H. E. Price, equipment sales manager at Fort Dunlop, has joined the board of the Foleshill company.

* * *

Mr. A. P. Gibbs, who has been for twenty years with Ransome and Marles Bearing Co., Ltd., Newark-on-Trent, has been appointed the firm's north-western area manager, with new offices at 5, John Dalton Street, Manchester, 2. He will be assisted by Messrs. E. H. Holmes and J. Beaumont.

* * *

Mr. Sidney Player, chairman of the Newall group of companies, has joined the board of E. H. Jones (Machine Tools), Ltd. Mr. E. H. Jones has joined the Newall board, and the latter's son, Mr. E. J. M. Jones, succeeds Mr. C. E. Rockwell (retired) as director and general manager. Mr. E. S. Hammett, chief designer, has transferred to the Motor Gear and Engineering Co., Ltd., and is succeeded by Mr. Brice, assisted by Mr. Wilson.

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

ECONOMICS OR EXTRAVAGANCE?

Any Portal in a Storm

WITH reference to your excellent article in *Flight* of October 25th in regard to the disposal of surplus Government equipment, other than by destroying it, a query was raised as to what should be done with old-age flying boats.

Surely the answer is to remove the wings and engines, and use them for living in, in view of their nicely equipped galleys, bunks, electric lighting, etc. They would give the alternative of being usable either on land, or on inland waterways.

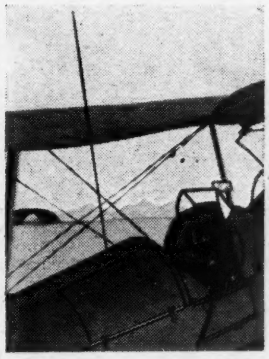
C. VINTEN.

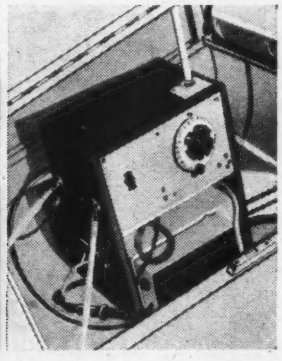
RADIO FOR LIGHT AIRCRAFT

Successful Experiment in a Tiger Moth

I WAS interested in the letter from Mr. Douglas Deans (*Flight*, September 6th) concerning radio for light aircraft. I enclose drawings showing a small unofficial installation for a five-metre transmitter-receiver fitted to a Tiger Moth.

The aerial is of the whip type, coming through a fairlead on the top of the fuselage just above the luggage compartment. This whip aerial is detachable.





The transmitter-receiver is housed in the luggage compartment just behind the rear cockpit and is quickly detachable, as it is only held in place by four shock-absorber cables with hook and eye attachment. The lead for the cockpit microphone and for the earphones can be of sufficient length to extend for use in either front or rear cockpit.

In the air, this little set gave excellent results up to a distance of 12 miles both for transmission and reception with the aircraft at 1,000ft. above the level of the airfield with which communication was being established.

P. H.

TWIN TRAINERS

"Wheelers" Preferable With an Oxford

AFTER some 2,000 hrs. flying on twin and single-engined aircraft in Canada I was a pupil at an A.F.U. in this country during the early months of this year. In Canada it had been a common practice to correct a swing on landing in a twin-engined aircraft by using the inside engine, but at A.F.U. it was definitely not recommended, and the method mentioned by "Indicator" (*Flight*, October 18th) was insisted upon.

Three-point landings were taught, but very few pilots carried them out, for the following reasons. I have yet to see a three-point landing carried out in an Oxford without seeing the pilot give a vigorous tug on the control column to ensure a perfect three-point attitude. It would appear that during the levelling-out prior to touching down, the Oxford can be brought to an almost three-point attitude with smooth handling of the controls, and at this point either a tail-down wheeler can be done or else a vigorous pull at the point of stall to ensure a three-point landing.

The insistence of the three-point landing under all conditions is as hard to explain as the insistence in some quarters of full flap on landing in any wind conditions. "Indicator" seems to regret that wheelers are taught, judging by his observations. That the three-point landing under all conditions is archaic is borne out by the increasing popularity of tricycle undercarriages on modern military and civil aircraft. It is only necessary when landing on rough ground and when carrying out a precautionary landing.

The Oxford, if wheeled on and the tail kept up in the air until the last moment, will not develop any swing when the tail comes down that cannot be corrected by rudder alone unless the swing is assisted by a cross-wind. If the Oxford is three-pointed the swing is much more noticeable, depending on the aircraft. The above observations are based on at least 15 hours on circuits and landings carried out, at the end of the course when there were no postings available, with a view of settling in my own mind what were the landing characteristics of the Oxford about which there has been so much discussion. The result was that in an Oxford a wheel landing is definitely preferable especially for those pilots who believe that the controls of an aircraft should be handled smoothly so as not to inconvenience the passengers.

"ULYSSES."

CAMPAIGN AWARDS

Recognition for Flying Instructors

W/O. WAKEFORD appears to be badly misinformed upon the position of awards to flying instructors. We resent his suggestion (*Flight*, November 1st) that most of us are awarded the A.F.C. or A.F.M.; in point of fact, there are on this unit three A.F.C.s held by senior officers, and no A.F.M.s. The remainder of us with two or three years' instructional experience hold nothing but the Defence Medal.

We do not desire to shoot any line, but what we do desire is some recognition of the modest part we played in the Battle for Training.

FLYING INSTRUCTOR.

CONFLICTING FIGURES

Top Speed of the Fairey Firefly IV

RECENTLY, the doyen of air correspondents drew attention to the fact that conflicting figures of an aircraft's performance are issued by different interests. It is not unknown for the manufacturer to state one figure, for M.A.P. to issue another, and for Service technical handbooks to use yet other figures.

Some such confusion appears to have arisen concerning the Firefly IV, which was cited in the official booklet of the flying display at Farnborough on October 30th as having a top speed of "300 knots." How this figure, which is inaccurate, is arrived at is not known in this company. The present top speed of the Firefly IV is 386 m.p.h. at 14,000 ft.—the figure which was given by the Admiralty in the official release to the Press at the Heston display, October 2nd, 1945.

B. J. HURREN, Sales Development Manager,
The Fairey Aviation Co., Ltd.

NATIONALISED AIRWAYS

Dangers of No Competition

IT is with grave concern that I read of this proposed Act to nationalise air transport companies.

With no competition on inland air services, are we going to have to sit on seats as uncomfortable as those in utility buses? There will be nothing to stop it except that the only competition will be the far slower rail. What will happen to fares? What of the officials? Will they adopt the customary attitude of food office clerks, or will they be polite and helpful?

With the railways not able to invest a halfpenny in airlines, it is possible that railway connections with aircraft arriving at airports several miles from the big cities will leave much to be desired. The Government won't run their schedules to suit the railways and vice versa.

The airlines of the U.S.A. show the great advantages of private enterprise, and unless we are very careful we shall find that instead of using our own services to foreign countries we shall use theirs. Still, on that side we shall have competition, but it does not alter the fact that on the inland routes we shall have none.

If they must, let them nationalise overseas routes, where competition will be there, but not inland routes where it will not.

I will end by saying that I hope the day the Act is passed will not turn out to be the blackest in the history of British civil aviation. Let it be remembered that during the war we had the most efficient air service over Europe. Let us hope it will be the same in peace.

T. F. FEVERHEERD.

Halifax A-IX Airborne Transport

New Version of Handley Page Bomber : Bomb Bay to Carry Fuel or Supplies

Illustrated by "Flight" photographs

MEETING the requirements of both the R.A.F. and the Airborne Forces, Handley Pages have produced a specialised version of the Halifax and designated it the A-IX.

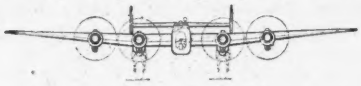
Although designed primarily for use by the Airborne Forces, it can still be operated as a bomber or transport. A crew of six is carried, and there is accommodation for 16 fully-equipped paratroops and two dispatchers.

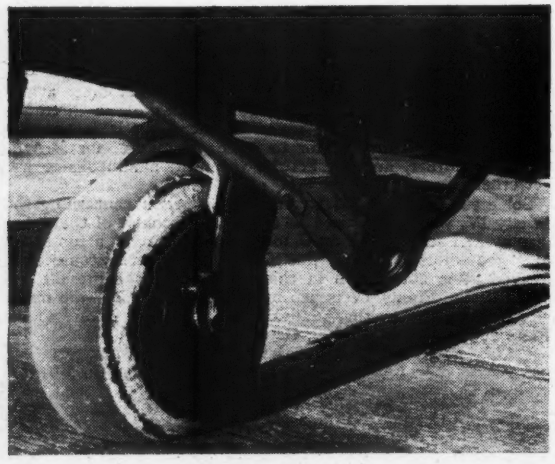
The outline of the aircraft is scarcely altered, but internally there are a number of innovations. The rear turret, which formerly carried four 0.303in. machine guns, is now replaced by a Boulton Paul D turret mounting two 0.5in. guns. There is no mid-upper gun position.

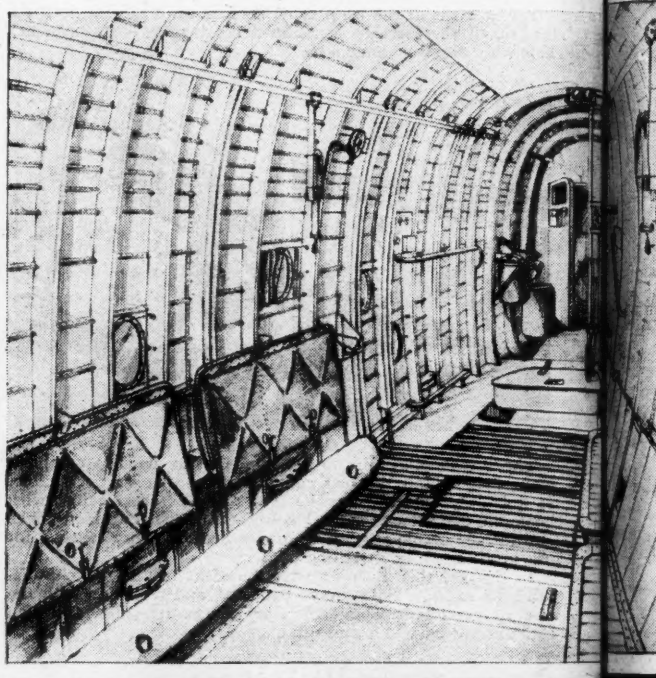
An inward-opening main entrance door also provides the paratroop exit. The dimensions of the door are 33in. by 59in., and it is operated by a hand lever on the port wall of the fuselage. Two rails take the static lines from the paratroops' canopies and, after a drop, these lines are hauled aboard by winches attached to the rear spar. On the ceiling of the fuselage, immediately above the jumping aperture, there is a signalling panel operated by the air bomber who "aims" the paratroops or supplies. All the crew and paratroop positions have controlled heating available to counteract cold weather or high-flying conditions. Considerable supplies of oxygen are also carried. The batteries of oxygen bottles are in the floor, below the flight engineer's position.

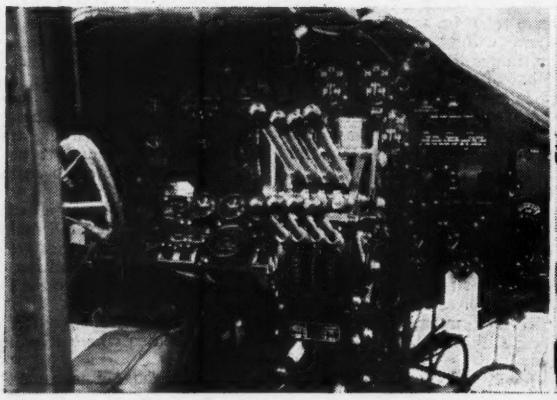
A streamline pannier may be fitted into the bomb bay to carry 8,000 lb. of military equipment or, if required, long-range fuel tanks can take the place of the pannier.

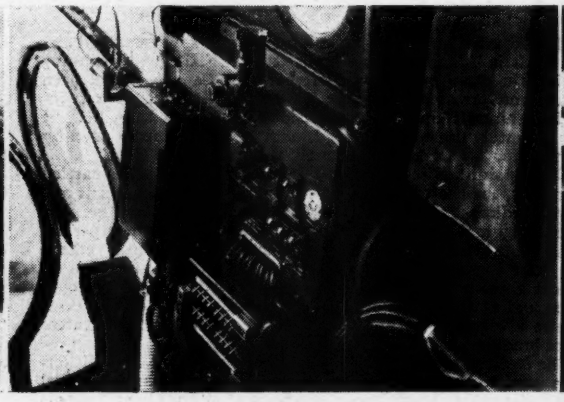
Two large-capacity "J" type inflatable dinghies are provided for the safety of the crew, and stowage space is available for "K" dinghies for both crew and troops.





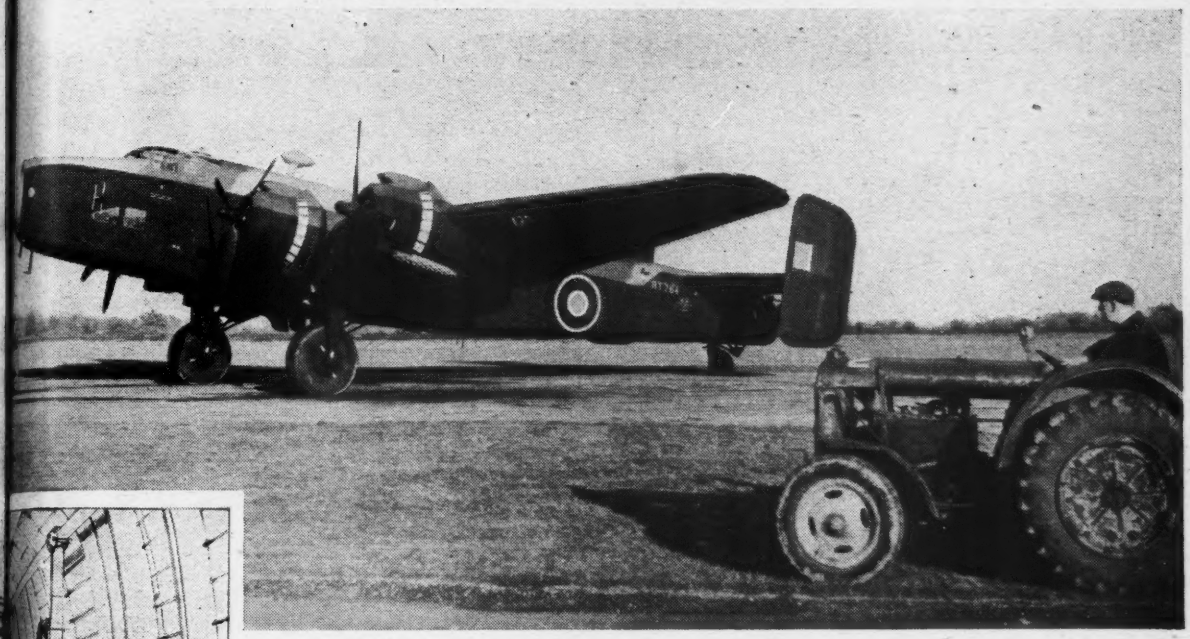


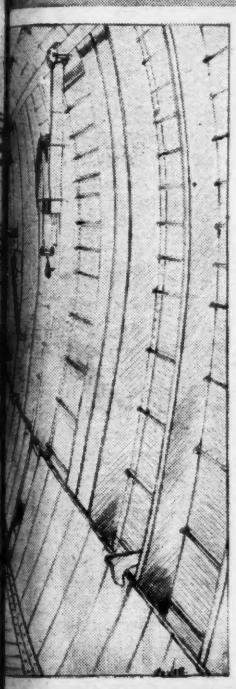




(Top) The retractable tailwheel and the glider-towing cable attachment. (Bottom) A glimpse of the pilot's cockpit showing the engine control box.

The air bomber's panel with its row of bomb selector switches is on the starboard side of the clear-vision nose. The release switch is stowed in a spring clip.

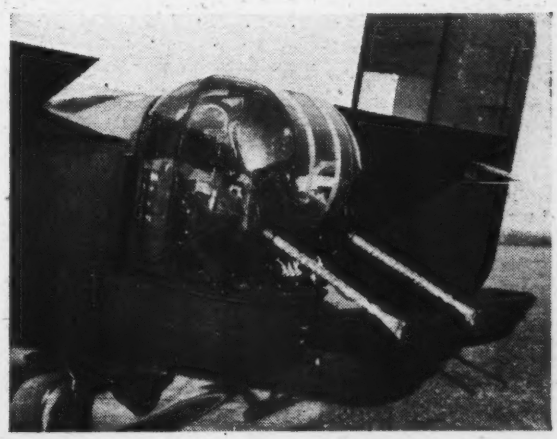




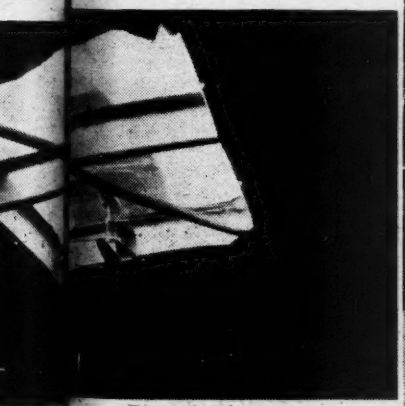
The exterior of the A-IX shows little change, but the drawing of the interior illustrates the many changes in internal economy which have taken place. After seeing the sheet metal seats, no one can say that our paratroops go to war in comfort.

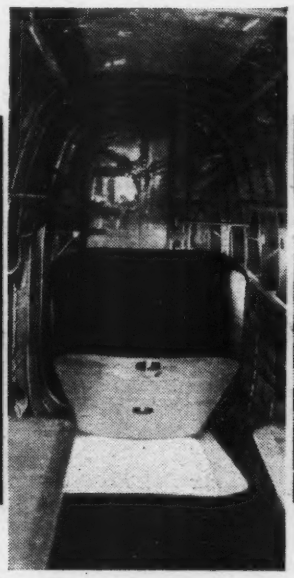
Handley Page Halifax A-IX

Max. speed (full load at 22,000ft.) 320 m.p.h.
Range (full load at economical cruising) ... ... 2,080 miles
Max. load ... ... 8,699 lb.
Four 1675 h.p. Bristol Hercules XVI engines.

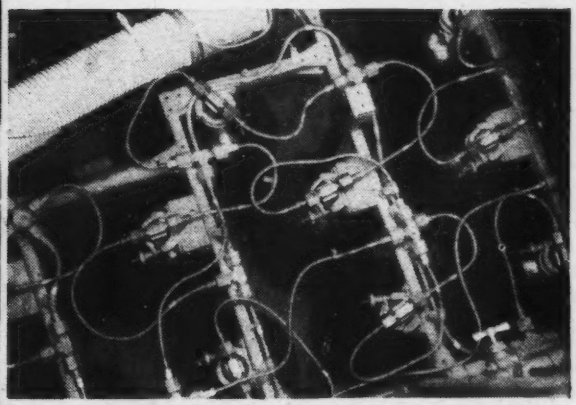


(Below) The massive-looking entrance door in the half-open position. It is raised and lowered by a lever on the fuselage wall.



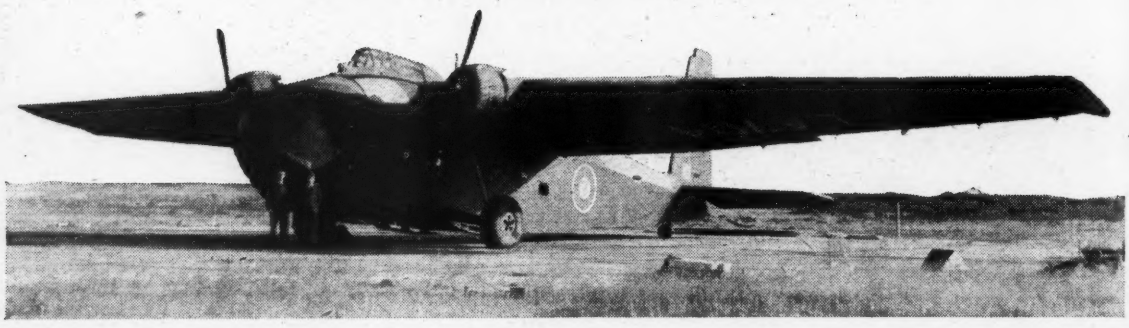


Escape hatches are provided in the roof. The D.F. aerial can be seen on the roof.



(Centre) Two 0.5in. machine guns are now carried in the tail. The elevators are shown in the "parked" up position. (Bottom) Part of the store of oxygen bottles.

Hamilcar X



Famous Load-carrying Glider Now Engine-assisted : Two Bristol Mercury XXXIs Facilitate Take-off and Cruising : "Returned Empty" Flights Without Tug

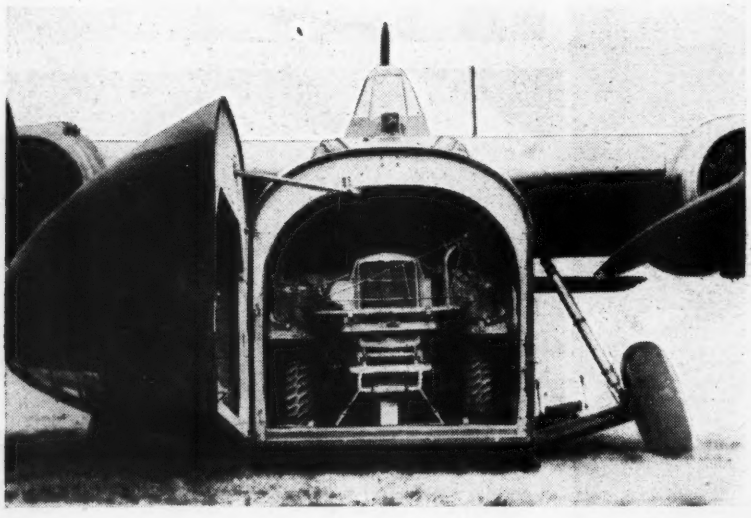
IF one is faced with the problem of carrying quantities of freight from point A to point B (a journey entailing an over-water trip), and the operation must be performed in the minimum time, then air transport is the answer. But air carriage of bulky, high-density loads in large quantities is one of the worst possible operational cases in that it needs large, powerful and specialised aircraft to do the job.

Such a problem confronted the planners of our invasion of the Continent, and the answer they found was the General Aircraft Hamilcar glider, a full and detailed description of which was published in the December 14th, 1944, issue of *Flight*. The glider was designed to carry a military load of 17,500 lb. (7.8 tons) for an all-up weight of 37,000 lb. It was the largest and heaviest aircraft which it was possible to envisage, at that time, as being capable of safe take-off and climb from a 2,000-yard runway in temperate conditions, using the most up-to-date four-engine bomber as a tug. Stirling, Lancaster and Halifax bombers were the available tug aircraft and the eventual selection fell upon the Halifax III.

In this form the Hamilcar successfully took part in the airborne operations on D-Day, at Arnhem and at the Rhine crossing. Even then, however, preparations were under-way to invest the Hamilcar with power assistance in order to improve the take-off of the glider/tug combination under tropical conditions from possibly indifferent airfields, and, furthermore, to increase the operational radius of action. It was also desirable for the power-assisted Hamilcar to be capable of independent flight at light load so that it could return under its own power from an operation, and at the same time be far more suitable for air transport use.

Simplified Installation

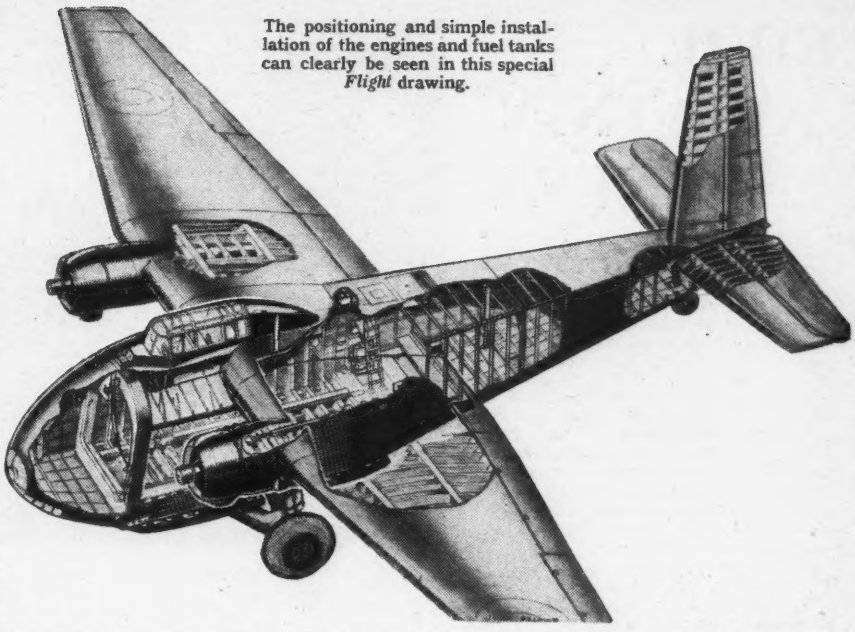
The result of these deliberations was the Hamilcar X, the all-up weight of which has been increased from 37,000 lb to 47,000 lb., whilst still having a military load of 17,500 lb and retaining the good aerodynamic characteristics of the Hamilcar I. The engines are Bristol Mercury XXXIs, which are simplified so as to require only the throttles in the cockpit; the mixture controls are interconnected with the throttles, and cowling gills have been deleted in favour of a permanently flared skirt to each cowling. No airscrew controls are required as the engines are fitted with two blade fixed-pitch wooden airscrews with blades of Douglas Fir on Jicwood roots, and at 130 lb. each these are just about the lightest airscrews for their size it is possible to have.



This gives a good idea of cabin capacity and the low level loading.

Power assistance is used throughout the glider's flight, the drill being that take-off is accomplished with all six engines of the combination doing their utmost, and when at the desired altitude the glider's engines are throttled to cruising condition for straight and level flight. The ideal case is for the glider's fuel to be totally consumed at the landing, leaving the tug with a little under half the take-off fuel load for its return journey to base. The normal fuel load carried by the Hamilcar X is 400 gallons, which is enough for an operational range of 690 miles, and up to this range the Hamilcar can be used as a solo aircraft if it is required to return to base by itself. Furthermore, as the tare weight is 29,500 lb. and the maximum solo take-off weight is 32,500 lb., it can carry a maximum payload of 3,000 lb. for the return journey. For ranges in excess

HAMILCAR X



The positioning and simple installation of the engines and fuel tanks can clearly be seen in this special *Flight* drawing.

of 690 miles the Hamilcar can be equipped with an additional 460-gallon tank, which increases the solo range to 1,530 miles, although in this case no payload can be carried for the return journey.

Basically the powered and glider Hamilcars are virtually identical; the forward main frame of the fuselage, which picks up to the front wing spar, has been strengthened and is now steel-faced on both sides, with laminated wood in-filling. Having engines has also necessitated superseding the original bifurcated tow arrangement by a single-point anchorage just forward of the pilot's front screen. This in turn has necessitated strengthening of the front frame of the fuselage at the door opening to accommodate a proportion of the towing load and, as a concession to the stressing arrangement of the original bifurcated tow, twin tubular struts now extend as a vee-bracing from the towing point to the base of the centre-section front spar.

Engine installation has been kept as simple as possible, each Mercury being carried on four "longeron" square-section tubular members, with Warren girder in-bracing, which are carried off the front face of the front spar. This simple mounting extends to the fire wall, forward of which the engine is carried on a Martinet-type mounting. A Sea-Otter type exhaust shroud collector ring is used, and the carburettor intake, incorporating a Vokes filter, is of the Martinet pattern.

Modification has been made to the undercarriage which, it may be remembered, is arranged to collapse in order to facilitate loading and unloading. A new feature is the incorporation of twin hydraulic hand-pumps on each side by means of which the collapsed leg can be pumped up to normal again. Oil in the oleo-leg is allowed to escape into a transparent plastic reservoir of streamline section (which acts as a trailing-edge fairing to the leg) so that it can be seen when all the oil has been pumped back. The twin pumps are housed on the after side of the axle member and the detachable handles are stowed adjacent to the pumps within the trailing edge of the axle fairing.

Having engines has affected the Hamilcar's characteristics only by requiring that the loads be stowed a little farther aft in the cabin. In the case of the Hamilcar I glider the large proportion of military load to all-up weight —almost 50 per cent.—made it impossible for the aircraft to be flown empty: when flying under light load conditions it was necessary to use ballast in order to obtain a suitable c.g. In the Hamilcar X, however, the maximum payload, whilst the same figure numerically, is approximately 30 per cent. of the all-up weight and the centre of gravity movement is much less sensitive to the variations of this load, and, as a consequence, the Hamilcar X can be flown at any load between the empty weight and the maximum all-up weight without the need for corrective ballast. At 47,000 lb., when off tow and with full engine power, the rate of descent is about 150 ft./min.; at 42,000 lb. height can just about be maintained with full power.

Future Use

Production of the Hamilcar X was intended for operations in 1946 in the Pacific, where the ability of the aircraft to return from an assault landing without tug assistance while at the same time carrying some useful load such as stretcher cases would have made it an invaluable asset to inter-island operations. Now, however, unless the machine is used by the authorities for urgent transport of some difficult loads—and there must be numerous instances on the Continent where invaluable use could be made of these qualities—it would appear that the peacetime utility of the aircraft is in some doubt.

It is envisaged that the Hamilcar X might be very useful to a civil concern if an ex-Service Halifax III could also be procured and used in combination. At first sight it would seem to be an expensive and elaborate way of securing air transport of freight in relation to the total fuel expenditure for carrying 17,500 lb. for 670 miles, the tug returning to base; but the scheme is not unpractical for transport of bulky, high-density loads, for the physical

(*Continued at the foot of page* 534.)

DIMENSIONS

Span, 110ft. Length, 68ft. Height, 20ft. 2in.	
Gross wing area	1,658 sq. ft.
Loadings: Wing loading (normal)	27.3 lb./sq. ft.
" " (overload)	28.3 lb./sq. ft.
Unrestricted cargo space dimensions, 27ft. 2in. long×6ft. 8in. high×8ft. wide.	
Capacity	1,440 cu. ft.

WEIGHTS

Weight empty	25,510 lb.
All-up weight	47,000 lb.
Payload	17,500 lb.

PERFORMANCE ON TOW

In towed flight at full load using a Halifax III tug aircraft: Towing speed, 150 m.p.h. Take-off distance to 50ft. screen, 1,040 yds.–1,750 yds., according to all-up weight of tug aircraft dictated by range requirements. Rate of climb at sea-level, 435 ft./min.–730 ft./min., according to tug weight.

SOLO PERFORMANCE

Take-off weight	32,500 lb.
Gross distance to 50ft. screen	1,385 yds.
Rate of climb at sea level	395 ft./min.
Max. speed	145 m.p.h.
Cruising speed	120 m.p.h.
Service ceiling	13,000ft.
Still air range on 400 gall. fuel	705 miles
Still air range on 860 gall. fuel (with overload tanks) ...	1,675 miles

BRISTOL MERCURY XXXI

	Supercharger ratio	b.h.p.	r.p.m.	Boost lb./sq. in.	Altitude ft.
Take-off	M	965	2,750	6.75	S.L.
All-out level (emergency, 5 min. limit)	M	965	2,750	6.75	1,000
Climb and max. continuous cruising (rich mixture) ...	M	810	2,400	4.25	2,500
Max. continuous cruising (economic mixture) ...	M	605	2,400	0.5	9,250

Fuel: 100 octane, specific consumption 0.550 pints/B.H.P./hr.
Oil: Consumption 3 gall./hr. at max. cont. cruising revs.

CIVIL AVIATION NEWS

PATHFINDERS GO TO SCHOOL AGAIN: As a necessary preliminary to becoming civil airline crews with British South American Airways, the selected initial team of R.A.F. Pathfinder pilots has been reintroduced to navigation from the transport angle. The Government's nationalisation plans may result in this praiseworthy effort being wasted.

I.A.T.A. CONFERENCES

THE three initial I.A.T.A. traffic conferences will be held in New York on January 8th, in Paris on February 12th, and in Cairo on February 21st.

IRISH AIRWAYS AGAIN

LAST week Aer Lingus Teoranta (alias Irish Airlines) restarted their direct Dublin-Croydon service, which has not been running since the outbreak of war. Recently purchased twenty-one-passenger DC-3s are being used, and the service is operated every week-day in each direction. It is possible that A.L.T. will soon be operating other runs. B.O.A.C. have so far been running the necessary ferry service between Rineanna and Croydon.

B.S.A.A. CARRY ON

OUTLINING the position, following the provisional declaration of Government policy, the British South American Airways' chairman, Mr. J. W. Booth, has stated that his company is prepared to co-operate with the Government and to discuss mutual plans in order that aircraft may be put on to the South American run as soon as possible.

He thinks it most unlikely that the Government would wish to scrap the organisation of trained personnel which have been built up during the last eighteen months, particularly since there must inevitably be a considerable delay while any new organisation gets under way. B.S.A.A. are ready to start immediate operations.

FROM BUCHAREST

THE little party of Roumanian airline pilots who recently flew ten delegates from Bucharest to attend the International Youth Conference in London have been making good use of their stay here. They were the first Roumanian aircrew members to visit England since pre-war days, and all served in the transport section of their country's Air Force. Under the auspices of the S.B.A.C. they have visited several British aircraft firms, notably de Havillands and Handley Pages, and also went to Croydon to inspect a York at the invitation of Avros.

They told *Flight* that one of the greatest shortages at present in Roumania is that of up-to-date technical aeronautical literature, and they spent some of their spare time in London in buying all the available handbooks. Incidentally, this literary shortage in Roumania has brought into existence a commercial venture which acquires all the printed technical "gen" and hires it out at decidedly stiff terms.

Their own airline company, L.A.R.E.S., has already started services, mainly of an "on demand" nature. The line still uses a pre-war D.H. Dragon Rapide (the only still-serviceable one of their seven pre-war British aircraft) and a number of Lockheed 14s, D.C.3s and Junkers aircraft. Roumania, they said, wanted British equipment and goods of all kinds and, when the political situation has been cleared up, they saw good prospects of a daily non-stop service between Bucharest and London.

The party came over in two pre-war Lockheed 14s via Strasbourg, and intend to call at Paris and Zurich on the way home.

BERMUDA COMPETITION

WHILE B.O.A.C. are still necessarily using Boeing Clippers for their twice-weekly service between New York and Bermuda, Pan American Airways have now put landplanes on the run and have increased the frequency to four times weekly. On a basis of a greater frequency and economy of operation, P.A.A. have, it is understood, reduced the return fare from £36 to £31 10s.

THE SCOTTISH AIRWAYS WINTER

OPERATING with a total of ten D.H.89 Rapides, Scottish Airways are this year running ten separate winter services to the Western Isles, the Orkneys and Shetland. In addition, they are running a service every week-day between Renfrew and Croydon, and two services every week-day between Renfrew and Belfast on behalf of Railway Air Services. The new civil Anson will shortly replace the Rapides on the Renfrew-Belfast run.

HUNDREDTH TO AUSTRALIA

LARGELY unknown to the general public, the B.O.A.C.-Qantas mail service to Australia has now been running regularly for nearly six months and the hundredth Lancastrian run over the route was completed last week.

The service actually started at the end of May this year, worked on a once-weekly basis until July, when the frequency was increased to two a week, and since August three weekly mail-cum-V.I.P. runs have been made. The total distance of twelve thousand miles is normally covered in sixty-three hours, B.O.A.C. crews flying from Hurn to Karachi, and Qantas Empire Airways crews taking over between Karachi and Sydney. There are only four intermediate stops between Hurn and Sydney.

Hamilcar X

Concluded from page 533

space characteristics of the Hamilcar are almost unique and when assessing the value of this particular combination this very important quality should be taken into consideration. It is not suggested that this is in any way the most desirable method of transporting heavy and bulky goods by air, but as a private concern might well be able to purchase a Hamilcar X and a Halifax III relatively cheaply (against the cost of a new specialised aircraft) it is a scheme worthy of more than passing thought. A further advantage is that the Halifax could also be used to carry a useful payload as well as acting in the capacity of tug. For example, at a still-air range of 690 miles the Halifax has a payload of 10,700 lb. which, with the Hamilcar's 17,500, gives an overall total payload of no less than 28,200 lb. (12.6 tons).

CIVIL AVIATION

Nationalisation

Utopia—with Snags : The Lords Debate the Government's Civil Aviation Proposals

THE debate on Civil Aviation in the House of Lords, resumed on Tuesday of last week, did not produce much support for the Government's intention to nationalise three operating corporations. It was opened by LORD BALFOUR OF INCHRYE, better known to aviation as Capt. H. H. Balfour, former Under-Secretary of State for Air. His main complaint was not that the Socialist Government had begun to nationalise—that had been expected—but that it had chosen for the first experiment the most unsuitable industry, an industry at its beginning, in which the qualities of tenacity and adventure were essential, qualities which certainly could not be found in the pigeonholes and behind the desks of Whitehall.

Surely, he thought, there might have been something better than the sacrifice of the national interest for what was in effect a doctrinaire principle. He quoted Lord Winster's remark, made on November 1st, that "public ownership shall be the overruling principle in air transport," and pointed out that it was not efficiency, economy, or safety of operation, or the achievement of results which was to be the determining factor but the fulfilment of a political theory. He described the plan as "bureaucracy run wild." The boards of the three corporations would be "phoney" boards of "dummy directors."

Interference

Of the intention of the Minister of Civil Aviation not to interfere in the day-to-day administration of the corporations Lord Balfour said that the Minister would not be able to avoid doing so. He was the servant of Parliament, and Parliament would, quite rightly, call upon the Minister, when it wished, for an account of his stewardship. He also asked for particulars of the principles upon which the finance of the corporations was to be established. He trounced the Minister soundly over charter flying and pointed out (as we pointed out in these columns last week) that private charter will be faced with competition from the Government-owned corporations.

Lord Balfour concluded by pointing out the essential difference between the 1939 Act, which gave B.O.A.C. a monopoly of subsidies but not of operation, and the proposed Act, which would give a monopoly of the air for commercial operation to a chosen few. He believed the Government had done the worst service possible to Britain by introducing this policy.

LORD REITH (who was the first chairman of B.O.A.C.) said he really knew something about these public corporations. He did not believe Lord Winster was primarily motivated by Party political considerations, but was quite in accordance with the trend of public opinion generally and, more important, in accordance with the hard economic facts of experience in public services. He thought Lord Winster had adopted the major points and best points in Lord Swinton's White Paper and had rationalised the rest.

Commenting on Lord Rennell's remarks in the first debate, concerning the difficulties of public corporations dealing with foreign privately owned concerns, Lord Reith did not agree there was any difficulty, and he spoke from personal experience. He did not feel that, in the Coalition Government, Lord Balfour and his then chief, the Secretary of State for Air (Sir Archibald Sinclair) had done all they might to prevent British civil aviation from being in the unfortunate position of to-day. He made it clear that with him it was not a question of Party politics and that on the whole he would prefer private enterprise to nationalisation if that meant conduct of public services by a Government department, politicians and civil servants.

Ownership *v.* Management

Lord Reith explained what he had meant when he referred to "hard economic facts." The term "public corporation" was often deliberately misunderstood. From the Right it was argued that that ownership meant management, which it did not and must not mean. From the Left there had been periodic attempts to treat the public corporation as if it were a Government department. "The chief characteristic," Lord Reith said, "of the public corporation system is that it is established and owned by the State, but not—repeat not—managed by the State." He concluded by asking the Minister of Civil Aviation if he would give the corporations freedom of management. Would he ensure that in securing the release of this vital service from the trammels of the Air Ministry we had not merely exchanged one hierarchy of civil servants for another? Would he be personally available to the chairmen of the corporations? And would he consider establishing some central co-ordinating, advisory body?

Jurisdiction by Council?

THE MARQUESS OF LONDONDERRY said that he had had enough experience of aviation to know that the profit motive had to come into the picture, but the enthusiasm and the wholehearted co-operation and support they had always received from everybody in the industry had been the mainspring of the success on which this country had depended. He suggested that the Minister of Civil Aviation should set up a Civil Air Council and later a Civil Aeronautics Authority comparable with the American body and to have jurisdiction instead of this being in the hands of a Government department. He complained that lately it was found that no decisions were being made at the Ministry of Aircraft Production and asked what was the position. Would M.A.P. give orders on their own behalf or on behalf of the Minister? What were their relations to all the aircraft manufacturers?

LORD BRABAZON OF TARA agreed with Lord Reith that the question of civil aviation was not a Party affair. He recalled that the Coalition Government had set up the State-owned B.O.A.C. Lord Swinton introduced the other agencies. In America it was laid down that surface transport should have no part in air transport. It was a matter of opinion, not Party politics. He did not agree with the idea of three corporations. He preferred a single over-riding organisation with the operating groups subordinate to it. He asked for information about the tribunal, the C.A.A., and if it was to fix fares and allocate routes. At present the trouble was that the Air Force had gone transport mad. One-quarter of their organisation was in Transport Command, and they had taken no trouble to get transport machines. Their safety record was very poor. It was high time that Transport Command was reduced in size to a skeleton peacetime level and B.O.A.C. given the work they were intended to do. While promising Lord Winster all assistance from the Brabazon Committee, Lord Brabazon hoped that soon B.O.A.C. would be able to go direct to the manufacturer and say what they wanted. M.A.P. was simply a delaying post office.

VISCOUNT ADDISON argued that the most important thing was safety. That was most likely to be ensured by the proposed scheme in which the organisation was subject to Parliamentary control. The R.A.F. had built up a standard of training second to none in the service of the State.

A Scots View

THE EARL OF GLASGOW said that Scottish people did not wish to have nationalisation of Scottish aviation on the English model and run from Whitehall. They had at Prestwick an international airport, the operators of which had had six years' experience, and they wanted to utilise that experience. He found it surprising that the Labour Government had not taken advantage of the experience of America, with its Civil Aeronautics Board, which had regulated competition and proved that it could bring cheap, efficient air service to the people and, surprisingly enough, enabled the airlines to bring revenue into the national exchequer, thus laying no burden on the taxpayer.

VISCOUNT ROTHERMERE recalled that some eighteen months ago Lord Winster had endorsed a strong plea on behalf of the shipping industry. He would like to know when the great vision struck him (Lord Winster) which converted him to an entirely different belief. He (Viscount Rothermere) did not propose to be converted to a belief that nationalisation was good for the country. He thought it was extremely bad, and that it would not be successful, however much it might be covered up in the financial estimates which would be presented to Parliament from time to time. If one studied the history of civil aviation in this country it was found that it had never been pushed forward by any Government, but

NATIONALISATION

always by enterprising individuals. He quoted from a previous speech by Lord Winster in which the importance of export was stressed; and pointed out that air transport formed one of the invisible exports necessary to balance our imports.

EARL AMHERST pleaded for the early establishment of an overall Civil Air Navigation Control; hoped that the radar adopted for civil flying would be the "Gee" system which was available and British; criticised the temporary arrangement of using Croydon and part of Northolt while Heathrow was being finished; pleaded that some machinery should be devised (possibly by B.O.A.C. acting temporarily) for engaging personnel immediately, otherwise there would be long delays while legislation was being prepared.

LORD SEMPILL called attention to the fact that air transport made little headway in America from 1919 to 1931. Then came the Civil Aeronautics Board and the Civil Aeronautics Authority, and matters took a very different turn. He had hoped that the Minister would have taken some note of the U.S.A. experience and tried to create a similar organisation here. He criticised the use of Hurn for transatlantic passengers and suggested that Prestwick had the facilities and could be linked with London by an air shuttle service in two hours. He regretted that the A.T.A. had been disbanded. It had a number of experienced pilots and a first-class ground organisation.

On the technical side Lord Sempill advocated that the Minister should take steps to ensure that all future air transport machines should be powered by gas turbine units, a field in which Great Britain held the lead. He would like to know if a certain number of small aircraft might be made available for private flying, and whether the Minister would say if it was intended to continue and increase the subsidies to clubs. At present firms were given no encouragement to build new light types, yet the export of such types would help and would "show the flag."

LORD SHERWOOD wanted to know what B.O.A.C. was costing the country. There were now to be three corporations, and they would cost a great deal of money. He could not see that three corporations were going to be of real benefit in working civil aviation. Let it be under one head, he suggested, and if necessary have separate divisions. He would like to know the terms of reference of the tribunal, and whether it was going to have an independent chairman. Certain aerodromes were to be taken over. He would like to know what was being done to see that those not taken over would have the same benefits. One could not have some flying safe, some fairly safe, and some dangerous. He did not believe that it was only by private enterprise that public work could be successfully carried out, but a great deal devolved on the Minister. It was up to him to choose people with real initiative. If he failed in that the whole scheme would fail. As for civil aviation now having the same equality as the R.A.F. and Fleet Air Arm, if the Ministry of Aircraft Production were concerned he would not mind, but he was not happy about aviation being handed over to the Ministry of Supply.

New Blood for B.O.A.C.?

LORD MORRIS did not welcome the use of Prestwick, which was 400 miles from London. He was deeply interested in Heathrow, "a fog-bound piece of land near Slough, which has cost the taxpayer quite a lot of money," and asked for full information about it. He suggested that the Minister should look into the suitability of Langston Harbour, near Portsmouth, where he would have at once at his disposal both a land and a marine airport. Lord Morris next turned to B.O.A.C. He wanted to know what the Minister had meant when he said he would "strengthen" the board. The time for injections had passed, and the proper thing to do was to scrap it entirely, allow Mr. Marchbank to return to his trade union, Sir Harold Howitt to his accountancy, Mr. Simon Marks to his department stores, and Miss Pauline Gower to her husband. We had reached a stage when B.O.A.C. must be administered by people in the industry, or who had an intimate knowledge of the industry. How much longer, he asked, was the taxpayer to pay the salaries of Brigadier-General Critchley and his associates? The Government should get back into the service of the country some of the very able technicians who had left or been discharged, men like Woods-Humphery, Burchall, Dismore, Walker, Mayo, Burke, Handover and Waugh. These men had been replaced by people who, if his information was correct, were totally unfitted for their posts.

LORD WINSTER, replying to the debate, said surface interests would take a larger view of their public responsibilities than Lord Swinton had credited them with. He was opposed to the sealed-pattern form of management, and wanted several methods of approach. As for ordering aircraft, he wanted operators and manufacturers to be in the very closest touch. He recalled that B.O.A.C. had operated one of the most difficult air routes in the world successfully and without partners. If one publicly owned corporation could do that, he failed to understand why other corporations should not be able to make a success of their work. Lord Rennell had asked how passenger allocation to air and shipping was to be effected. The passengers themselves would do that. Traffic returns would show how many wished to travel by each method, and the capacities would be adjusted accordingly.

To Lord Balfour he would say that public ownership was not to be an overriding consideration, putting safety second. He regretted the reference to "phoney" boards, and as for not interfering in administration, he was willing to substitute the word "management." As for charter flying, Lord Winster said he had made it clear that he did not wish to knock private flying on the head. Lord Reith had asked several questions. The corporations would be allowed to do business direct with other concerns. He regarded that as coming under the heading of day-to-day management. He said the Minister would be fully accessible to the chairmen of the corporations. The suggestion of something in the nature of a Civil Aviation Board would be taken into consideration.

Replying to Lord Londonderry, the Minister said there were interim agreements by which they allowed the American Government to come in. They wished to facilitate this in every way and were doing their best to secure the most suitable airports for their reception.

Other points from Lord Winster's reply are: B.O.A.C. intended to operate a transatlantic air service via Prestwick. The number of services would depend upon the traffic offering. The Swedes had asked permission to use Prestwick for a series of experimental flights over the Atlantic this winter, and permission had been given. Scottish services would be operated by one of the corporations, and full advantage would be taken of the experience existing in Scotland. He was conscious of the need for more aerodromes than Northolt, and he was out to get more. The Secretary of State for Air was being extremely helpful.

VISIBLE EXPORT: The first of the four civil-version Sunderlands ordered by the South American shipping line Compania Argentina de Navegacion Dodero is launched at the Short and Harland works at Queen's Island, Belfast, by Senora de Dodero, wife of the shipping line's chairman. As far back as 1943, Mr. Evelyn Baring went to Buenos Aires to discuss the possibilities of British aircraft, and within a few days of V.E.-Day the Dodero line was able to confirm the purchase of the four Sunderlands.

LIGHTWEIGHT

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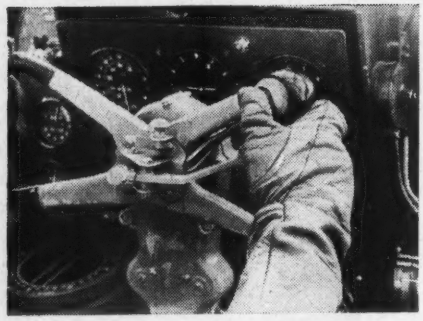
IN THE AIR—IV

Flying the Blenheim

Another of a Series of Impressions of Famous Wartime Aircraft : First of the High-efficiency Twins : Becoming "Safety-speed-conscious"



THE peculiar way in which, where aircraft are concerned, the "advanced and difficult" eventually becomes the "simple and straightforward," is almost perfectly exemplified in the history of the Blenheim. Only a few years ago the pilot of the Blenheim was considered something of a person, and it was for this type, I believe, that C.F.S first developed their "twin technique" and also, probably, the verbal "drill" system. With the former, they taught the tyro to hold a twin right down on the ground after take-off, to be interested only in single-engined safety speed, and to disregard initial gain of height; with the latter we were taught to mumble "H.T.M.P. F.G." before take-off—or, more explicitly, "Hydraulics, Trim, Mixture, Pitch, Flaps and Gills," to save us all from lethal absent-mindedness.

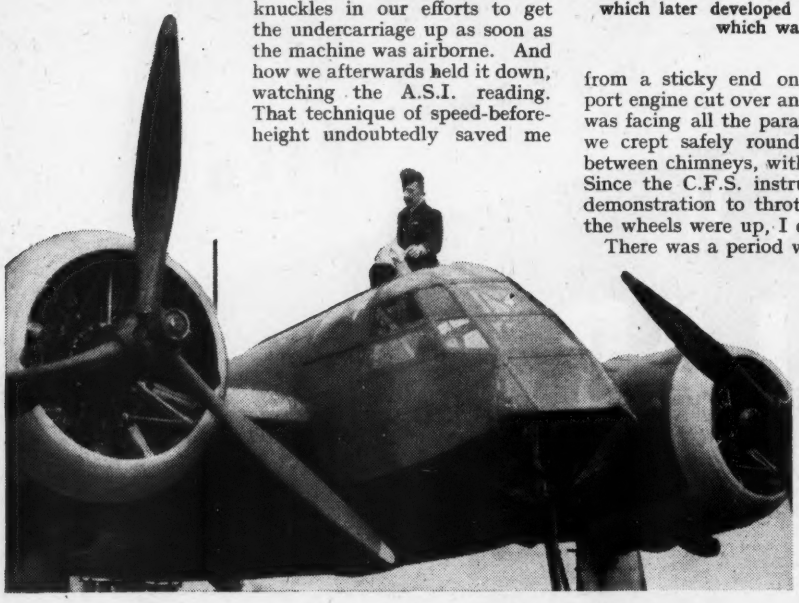
Puzzled Pilots

For in those days many such items were unusual, and the whole set-up had none of the "complicated simplicity" which appeared when hydraulics and constant-speed airscrews had become the more normal equipment of aircraft. Not only had the hydraulic power to be selected, but it needed to be selected on the plunger in the right direction on the Blenheim, or one would be merely providing urge for the satisfaction of a possibly non-existent rear-gunner.

And what a worried, contortionist business it all was, with the airscrew-pitch buttons and cut-outs behind one's left elbow and the hydraulic service controls, for all the world like old-fashioned lavatory handles, below and on the right. How we barked our knuckles in our efforts to get the undercarriage up as soon as the machine was airborne. And how we afterwards held it down, watching the A.S.I. reading. That technique of speed-before-height undoubtedly saved me from a sticky end on at least one take-off, when the port engine cut over an airfield boundary while the aircraft was facing all the paraphernalia of a large industrial city; we crept safely round to a landing, over factories and between chimneys, with 110-120 on the clock all the time. Since the C.F.S. instructors used simply as a routine of demonstration to throttle back *and* switch off as soon as the wheels were up, I couldn't even shoot a line about it.

There was a period when, after dozens of shocked pilots had raised the undercarriage instead of the flaps and, all unknown to the casual driver, a safety-catch was fitted to the undercarriage selector. In a wild effort to raise the undercarriage in the old way the floor was almost pulled out of the aircraft, and trips were made with undercarriage left down through

The most-used version of the Blenheim—the Mark IV, which later developed into the Mark V type, a version of which was known as the Bisley.



The first and, in "Indicator's" view, the nicest of the Blenheims—the Mark I, with its enormous area of transparency in the nose.

sheer ignorance. Even after we had been duly told about the secret catch, it was no easy matter to release it. First a spring-loaded lid had to be lifted and the handle grasped before the thumb could grope helplessly around for the trigger.

Because it was my first military twin—and, indeed, almost my first twin of any kind—I have always had an affection for the Blenheim, even when it had become merely a cast-off which was flown in and out of dispersal fields waiting for the moment either when it was wanted by somebody, or when the order came through to break it up. For the same reason, even in much later years, I always suffered a purely conditioned sense of half-fear when a Blenheim turned up for ferrying or test. Those days of 1939 when, with no previous experience of military aircraft or even of twins, we had flown along in a tense and over-heated state, with the left hand clutching maps and throttles together, and with the eyes alternately roaming the landscape and the oil temperature gauges, had left an indelible impression on the sub-conscious. The very shape and smell of a Blenheim were as distinctively remembered as those of any American aircraft.

Marked Differences

But the Mark I was the nicest of all the Blenheims, with its low all-up weight and its vast expanse of forward and downward view. Later marks became heavier and heavier, and, indeed, slower and slower as the necessary armament was piled on, until eventually, it didn't seem to be a Blenheim at all when there were constant-speed airscrews, when the undercarriage was raised by a lever and not by a piston affair on the right, and when the gills were motor-driven and not worked laboriously by wheel.

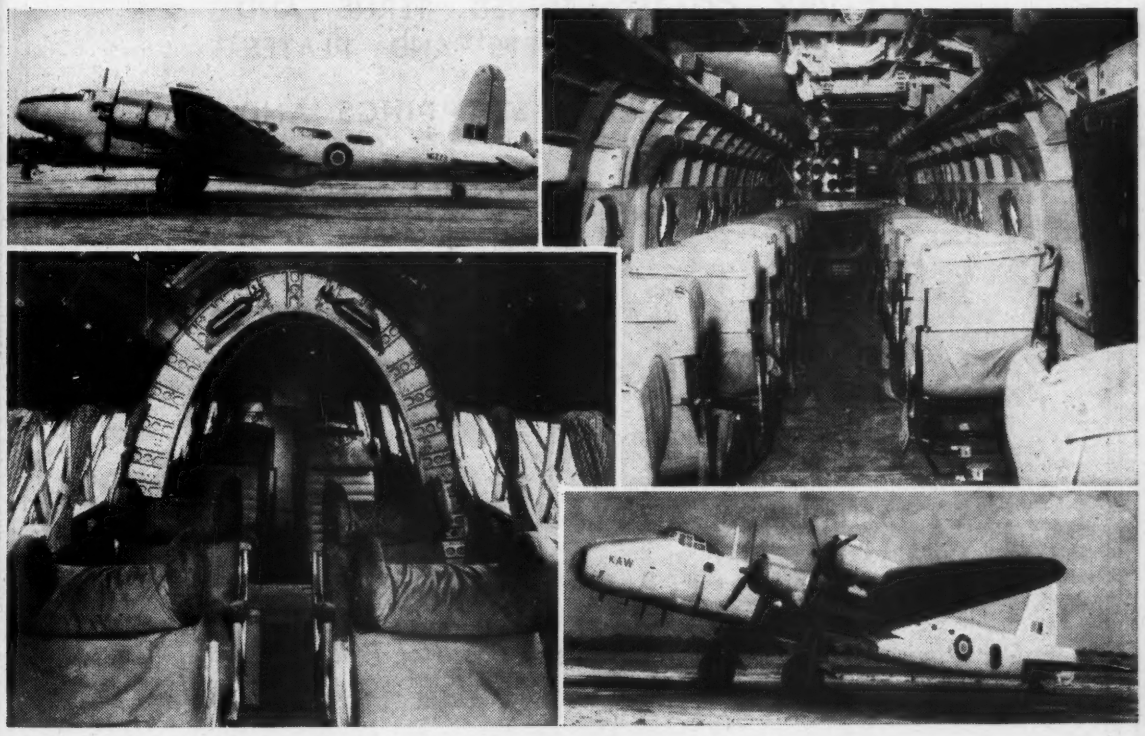
Getting into the Blenheim was always something of an affair, and one soon learnt not to attempt to do it while weighed down with a parachute. An assistant put this in the seat while the driver, hatted, gloved and inter-commed., clambered on to the port wing—slippery if wet—and through the roof hatch, letting himself down gently so that, even if the direction was poor, he did not damage his nether garments on the various pointed items surrounding the seat. It was peculiar at first, too, to find that the wings and ailerons were more or less invisible behind the engine cowlings—a disadvantage which was handsomely outweighed, in the sight of the amateur at least, by the most unusual way in which the landscape could be seen crawling along through the transparent floor of the nose. Later we were to become very accustomed to a more pronounced lateral blindness in Beaufighters and other types.

In the bowels of the ship, reached through a trap-door on the top of the fuselage, was a bath-tub affair comprising the centre-section. In it, if unlucky enough to be a passenger, one sat in noisy darkness, wondering whether things were really as bad as all that and hoping that the pilot wasn't rashly going over the top of the weather of which one had read in the Met. office. It was rather like being in a submarine and so much better to be in front where the accident could be seen arriving. I remember one terrifying trip in the "bath" while being flown by a very experienced ex-airline pilot who made a habit of going up through the overcast and hitting his destination on the nail with the aid of a stop-watch and a good deal of mysterious mental calculation. He was rarely to be seen with either a map or a slide-rule while flying, but his "groundfalls" were usually accurate within a few miles. On this occasion the rain beat incessantly on the fuselage, we sat in little puddles, and it was very, very dark.

As for flying characteristics, the Blenheim must have been very easy, since in the early days of the war we were poured more or less straight in from the cockpits of our Moths and found no particular difficulties, frightening though it all was.

"INDICATOR."

TRANSPORT COMMAND CONVERSIONS



The fuselage construction of the Short Stirling and the Vickers-Armstrongs Warwick make both of these aircraft suitable for adaptation as military passenger aircraft. The interior and exterior of the unarmed Stirling is shown on the right and the passenger Warwick, with a cabin bulge below the fuselage, is on the left.

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Atomic Energy

Review of Official Report on Atomic Bomb Development by U.S. Government

THE full text of the official U.S. Government report on the development of the atomic bomb has recently been published in America and here, in the form of a 264-page book* by Dr. H. D. Smyth, who is chairman of the Department of Physics at Princeton University and was engaged on the project in the capacity of consultant.

As presented, it is stated that laymen with even elementary scientific knowledge will understand the report in general, whilst scientists in any field will find it easy reading. We cannot agree. The knowledge of physics required to understand the report—even in general—would place a reader well out of the "lay" class, and it is quite on the cards that a scientist, unless he were pretty well up in modern trends of nuclear physics, might find the report somewhat more than an elementary exposition.

It is extremely comprehensive, and the only parts left out are those to which any official secrecy ban might conceivably apply; nevertheless, a remarkably complete picture of the undertaking is given, which is controlled only by the individual reader's ability to grasp the subject matter.

All-American

The author states in his preface that references to British and Canadian work are not intended to be complete (in the report) since it has been written from the point of view of the activities of America. This is, no doubt, a tenable postulate; equally it is one which we cannot help but regard as singularly unfortunate. An official Governmental report on any subject should be objective, and certainly should not exclude the part played by other Nationals purely because they *are* other Nationals. This smacks of a racial insularity of outlook which, if possible, makes the atomic bomb just that much more powerful as a potential vehicle of Armageddon.

We cannot give a factual review of this report in the true sense of the term. The subject is far too vast and too complex, apart from the intrinsic difficulty of reviewing purely scientific subject matter in lay terms; however, we have abstracted various sections of the report in order to give a reasonably clear synoptic survey. It should be noted that the cross-headings in dark type are our own.

Statement of the Problem.—From the time of the first discovery of the large amounts of energy released in nuclear reactions to the time of the discovery of uranium fission, the idea of atomic power or even atomic bombs was discussed off and on in scientific circles. The discovery of fission made this talk seem much less speculative, but realisation of atomic power still seemed in the distant future and there was an instinctive feeling among many scientists that it might not, in fact, ever be realised. During 1939 and 1940 many public statements, some of them by responsible scientists, called attention to the enormous energy available in uranium for explosives and for controlled power, so that U-235 became a familiar byword indicating great things to come. The possible military importance of uranium fission was called to the attention of the Government, and in a conference with representatives of the Navy Department in March, 1939, E. Fermi suggested the possibility of achieving a controllable reaction using slow neutrons or a reaction of an explosive character using fast neutrons. He pointed out, however, that the data then available might be insufficient for accurate predictions.

By the summer of 1940 it was possible to formulate the problem fairly clearly, although it was still far from possible to answer the various questions involved or even to decide whether a chain reaction ever could be obtained.

The Chain-Reaction Problem.—The principle of operation of an atomic bomb or power plant utilising uranium fission is simple enough. If one neutron causes a fission that produces more than one new neutron, the number of fissions may increase tremendously with the release of enormous amounts of energy. It is a question of probabilities. Neutrons produced in the fission process may escape entirely from the uranium, may be captured by uranium in a process not resulting in fission, or may be captured by an impurity. Thus the question of whether a chain reaction does or does not go depends on the result of a competition among four processes: (1) escape; (2) non-fission capture by uranium; (3) non-fission capture by impurities; (4) fission capture.

If the loss of neutrons by the first three processes is less than the surplus produced by the fourth, the chain reaction occurs; otherwise it does not. Evidently any one of the first three processes may have such a high probability in a given arrangement that the extra neutrons created by fission will be insufficient to keep the reaction going. For example, should it turn out that process (2)—non-fission capture by uranium—has a much higher probability than fission capture, there would presumably be no possibility of achieving a chain reaction.

An additional complication is that natural uranium contains three isotopes: U-234, U235 and U-238, present to the extent of approximately 0.006, 0.7 and 99.3 per cent. respectively.

Neutron Escape: Critical Size.—The relative number of neutrons which escape from a quantity of uranium can be minimised by changing the size and shape. In a sphere any surface effect is proportional to the square of the radius, and any volume effect is proportional to the cube of the radius. Now the escape of neutrons from a quantity of uranium is a surface effect depending on the area of the surface, but fission capture occurs throughout the material and is therefore a volume effect. Consequently, the greater the amount of uranium, the less probable it is that neutron escape will predominate over fission capture and prevent a chain reaction. Loss of neutrons by non-fission capture is a volume effect like neutron production by fission capture, so that increase in size makes no change in its relative importance.

Critical Size

The critical size of a device containing uranium is defined as the size for which the production of free neutrons by fission is just equal to their loss by escape and by non-fission capture. In other words, if the size is smaller than critical, then—by definition—no chain reaction will sustain itself. In principle it was possible in 1940 to calculate the critical size, but in practice the uncertainty of the constants involved was so great that the various estimates differed widely. It seemed not improbable that the critical size might be too large for practical purposes. Even now estimates for untried arrangements vary somewhat from time to time as new information becomes available.

For some years before the discovery of fission, the customary way of slowing down neutrons was to cause them to pass through material of low atomic weight, such as hydrogenous material. The process of slowing down, or moderation, is simply one of elastic collisions between high-speed particles and particles practically at rest. The more nearly identical the masses of neutron and struck particle the greater the loss of kinetic energy by the neutron. Therefore the light elements are most effective as "moderators," i.e., slowing-down agents, for neutrons.

It occurred to a number of physicists that it might be possible to mix uranium with a moderator in such a way that the high-speed fission neutrons, after being ejected from uranium and before re-encountering uranium nuclei, would have

BRIEFLY . . .

THE lay reader should not feel discouraged from studying this important review by the necessarily rather technical nature of the earlier extracts quoted, which set out the problems faced by the scientists in (to use the popular expression) first "splitting the atom."

From there the review goes on to show how the violent reactions in the atomic bomb were controlled so that the whole process of explosion was completed efficiently before the bomb flew apart and reaction stopped prematurely: and how premature explosion was prevented by the use of separate elements ultimately brought into sudden and perfect contact on a gun-and-target principle. It concludes with a note on the future use of nuclear energy for peaceful purposes and an expression of the scientists' feelings on the ultimate employment, for good or evil, of this fantastic discovery.

* "Atomic Energy for Military Purposes," by Henry D. Smyth. $1.25 (cloth edition $2). Princeton University Press, Princeton, N.J. Now obtainable from H.M. Stationery Office, London, at 2s. 6d. (postage 2d.).

their speeds reduced below the speeds for which non-fission capture is highly probable. Evidently the characteristics of a good moderator are that it should be of low atomic weight and that it should have little or no tendency to absorb neutrons. Lithium and boron are excluded on the latter count. Helium is difficult to use because it is a gas and forms no compounds. The choice of moderator therefore lay among hydrogen, deuterium, beryllium and carbon. Even now no one of these substances can be excluded from the list of practical possibilities. It was E. Fermi and L. Szilard who proposed the use of graphite as a moderator for a chain reaction.

A specific manner of using a moderator was first suggested in this county, so far as we can discover, by Fermi and Szilard—[it should be remembered that we are quoting Dr. Smyth, and that "this country" therefore means America.—ED., *Flight*]. The idea was to use lumps of uranium of considerable size embedded in a matrix of moderator material. Such a lattice can be shown to have real advantages over a homogeneous mixture. As the constants were more accurately determined, it became possible to calculate theoretically the type of lattice that would be most effective.

Impurities

The cross section for capture of neutrons varies greatly among different materials. In some it is very high compared to the maximum fission cross section of uranium. If, then, we are to hope to achieve a chain reaction, we must reduce effect (3)—non-fission capture by impurities—to the point where it is not serious. This means very careful purification of the uranium metal and very careful purification of the moderator. Calculations show that the maximum permissible concentrations of many impurity elements are a few parts per million—in either the uranium or the moderator. When it is recalled that up to 1940 the total amount of uranium metal produced in this country [i.e., America] was not more than a few grams and even this was of doubtful purity, that the total amount of metallic beryllium produced in this country was not more than a few pounds, that the total amount of concentrated deuterium produced was not more than a few pounds, and that carbon had never been produced in quantity with anything like the purity required of a moderator, it is clear that the problem of producing and purifying materials was a major one.

Control of the Chain Reaction.—The problems that have been discussed so far have to do merely with the realisation of the chain reaction. If such a reaction is going to be of use, we must be able to control it. The problem of control is different, depending on whether we are interested in steady production of power or in an explosion. In general, the steady production of atomic power requires a slow-neutron-induced fission chain reaction occurring in a mixture or lattice of uranium and moderator, while an atomic bomb requires a fast-neutron-induced fission chain reaction in U-235 or Pu-239, although both slow and fast-neutron fission may contribute in each case. It seemed likely, even in 1940, that by using neutron absorbers a power chain reaction could be controlled. It was also considered likely, though not certain, that such a chain reaction would be self-limiting by virtue of the power probability of fission-producing capture when a higher temperature was reached. Nevertheless, there was a possibility that a chain-reacting system might get out of control, and it therefore seemed necessary to perform the chain-reaction experiment in an uninhabited location.

Practical Application of the Chain Reaction.—Up to this point we have been discussing how to produce and control a nuclear chain reaction, but not how to make use of it. The technological gap between producing a controlled chain reaction and using it as a large-scale power source or an explosive is comparable to the gap between the discovery of fire and the manufacture of a steam locomotive.

ATOMIC ENERGY (CONTINUED)

Although production of power has never been the principal object of this project, enough attention has been given to the matter to reveal the major difficulty: the attainment of high-temperature operation. An effective heat engine must not only develop heat but must develop heat at a high temperature. To run a chain-reacting system at a high temperature and to convert the heat generated to useful work is very much more difficult than to run a chain-reacting system at a low temperature.

Of course, the proof that a chain reaction is possible does not itself ensure that nuclear energy can be effective in a bomb. To have an effective explosion it is necessary that the chain reaction builds up extremely rapidly; otherwise only a small amount of the nuclear energy will be utilised before the bomb flies apart and the reaction stops. It is also necessary that no premature explosion occurs. This entire "detonation" problem was and still remains one of the most difficult problems in designing a high-efficiency atomic bomb.

Plutonium

Possibility of Using Plutonium.—So far, all our discussion has been primarily concerned with the use of uranium itself. We have already mentioned the suggestion that the element of atomic number 94 and mass 239, commonly referred to as plutonium, might be very effective. Actually, we now believe it to be of value comparable to pure U-235. We have mentioned the difficulty of separating U-235 from the more abundant isotope U-238 These two isotopes are, of course, chemically identical. But plutonium, although produced from U-238, is a different chemical element. Therefore, if a process could be worked out for converting some of the U-238 to plutonium, a chemical separation of the plutonium from uranium might prove more practicable than the isotopic separation of U-235 from U-238.

Suppose that we have set up a controllable chain reaction in a lattice of natural uranium and a moderator—say, carbon—in the form of graphite. Then as the chain reaction proceeds, neutrons are emitted in the process of fission of the U-235 and many of these neutrons are absorbed by U-238. This produces U-239, each atom of which then emits a beta particle, becoming neptunium (Np). Neptunium, in turn, emits another beta particle, becoming plutonium (Pu), which emits an alpha particle, decaying again to U-235, but so slowly that in effect it is a stable element. If, after the reaction has been allowed to proceed for a considerable time, the mixture of metals is removed, it may be possible to extract the plutonium by chemical methods and purify it for use in a subsequent fission chain reaction of an explosive nature.

The course of a nuclear chain reaction in a graphite moderated heterogeneous pile can be described by following a single generation of neutrons. The original fast neutrons are slightly increased in number by fast fission, reduced by resonance absorption in U-238 and further reduced by absorption at thermal energies in graphite and other materials and by escape; the remaining neutrons, which have been slowed in the graphite, cause fission in U-235, producing a new generation of fast neutrons similar to the previous generation.

The product, plutonium, must be separated by chemical processes from a comparable quantity of fission products and a much larger quantity of uranium. Of several possible separation processes the one chosen consists of a series of reactions including precipitating with carriers, dissolving, oxidising and reducing.

Controlled Explosion

In our earlier discussions of chain reactions it was always taken for granted that the chain-reacting system must not blow up. Now we want to consider how to make it blow up.

By definition, an explosion is a sudden and violent release of a large amount of energy in a small region. To produce an efficient explosion in an atomic bomb, the parts of the bomb must not become appreciably separated before a substantial fraction of the available nuclear energy has been released, since expansion leads to increased escape of neutrons from the system and thus to premature termination of the chain reaction. Stated differently, the efficiency of the atomic bomb will depend on the ratio of (a) the speed with which neutrons generated by the first fissions get into other nuclei and produce further fission, and (b) the speed with which the bomb flies apart. Using known principles of energy generation, temperature and pressure rise, and expansion of solids and vapours, it was possible to estimate the order of magnitude of the time interval between the beginning and end of the nuclear chain reaction. Almost all the technical difficulties of the project come from the extraordinary brevity of this time interval.

The calculation of the critical size of a chain-reacting unit is a problem that has already been discussed in connection with piles. Although the calculation is simpler for a homogeneous metal unit than for a lattice, inaccuracies remained in the course of the early work, both because of lack of accurate knowledge of constants and because of mathematical difficulties. For example, the scattering, fission and absorption cross-sections of the nuclei involved all vary with neutron velocity. The details of such variations were not known experimentally and were difficult to take into account in making calculations. By the spring of 1943 several

estimates of critical size had been made, using various methods of calculation and using the best available nuclear constants, but the limits of error remained large.

The Reflector or Tamper.—In a uranium-graphite chain-reacting pile the critical size may be considerably reduced by surrounding the pile with a layer of graphite, since such an envelope "reflects" many neutrons back into the pile. A similar envelope can be used to reduce the critical size of the bomb, but here the envelope has an additional rôle: its very inertia delays the explosion of the reacting material. For this reason such an envelope is often called a tamper. Use of a tamper clearly makes for a longer lasting, more energetic and more efficient explosion. The most effective tamper is the one having the highest density; high tensile strength turns out to be unimportant. It is a fortunate coincidence that materials of high density are also excellent as reflectors of neutrons.

Efficiency.—As has already been remarked, the bomb tends to fly to bits as the reaction proceeds and this tends to stop the reaction. To calculate how much the bomb has to expand before the reaction stops is relatively simple. The calculation of how long this expansion takes and how far the reaction goes in that time is much more difficult.

While the effect of a tamper is to increase the efficiency both by reflecting neutrons and by delaying the expansion of the bomb, the effect on the efficiency is not as great as on the critical mass. The reason for this is that the process of reflection is relatively time-consuming and may not occur extensively before the chain reaction is terminated.

Producing Detonation

Detonation and Assembly.—It is impossible to prevent a chain reaction from occurring when the size exceeds the critical size. For there are always enough neutrons (from cosmic rays, from spontaneous fission reactions, or from alpha-particle-induced reactions in impurities) to initiate the chain. Thus until detonation is desired, the bomb must consist of a number of separate pieces, each one of which is below the critical size either by reason of small size or unfavourable shape. To produce detonation, the parts of the bomb must be brought together rapidly. In the course of this assembly process the chain reaction is likely to start—because of the presence of stray neutrons—before the bomb has reached its compact (most reactive) form. Thereupon the explosion tends to prevent the bomb from reaching that most compact form. Thus it may turn out that the explosion is so inefficient as to be relatively useless. The problem, therefore, is twofold: (1) to reduce the time of assembly to a minimum; and (2) to reduce the number of stray (predetonation) neutrons to a minimum.

Some consideration was given to the danger of producing a "dud" or a detonation so inefficient that even the bomb itself would not be completely destroyed. This would, of course, present the enemy with a supply of highly valuable material.

Effectiveness.—There was no assurance that one uranium bomb releasing energy equal to the energy released by 20,000 tons of T.N.T. would be as effective in producing military destruction as, say, 10,000 two-ton bombs. In fact, there were good reasons to believe that the destructive effect per calorie released decreases as the total amount of energy released increases. On the other hand, in atomic bombs the total amount of energy released per kilogram of fissionable material (i.e., the efficiency of energy release) increases with the size of the bomb. Thus the optimum size of the atomic bomb was not easily determined. A tactical aspect that complicates the

ATOMIC ENERGY (CONTINUED)

matter further is the advantage of simultaneous destruction of a large area of enemy territory. In a complete appraisal of the effectiveness of an atomic bomb, attention must also be given to effects on morale. The bomb is detonated in combat at such a height above the ground as to give the maximum blast effect against structures, and to disseminate the radioactive products as a cloud. On account of the height of the explosion practically all the radioactive products are carried upward in the ascending column of hot air and dispersed harmlessly over a wide area. Even in the New Mexico test, where the height of explosion was necessarily low, only a small fraction of the radioactivity was deposited immediately below the bomb.

Method of Assembly.—Since estimates had been made of the speed that would bring together subcritical masses of U-235 rapidly enough to avoid predetonation, a good deal of thought had been given to practical methods of doing this. The obvious method of very rapidly assembling an atomic bomb was to shoot one part as a projectile in a gun against a second part as a target. The projectile mass, projectile speed and gun calibre required were not far from the range of standard ordnance practice, but novel problems were introduced by the importance of achieving sudden and perfect contact between projectile and target, and by the use of tampers and by the requirement of portability.

It had also been realised that schemes probably might be devised whereby neutron absorbers could be incorporated in the bomb in such a way that they would be rendered less effective by the initial stages of the chain reactions. Thus the tendency for the bomb to detonate prematurely and inefficiently would be minimised. Such devices for increasing the efficiency of the bomb were called auto-catalytic.

A weapon has been developed that is potentially destructive beyond the wildest nightmares of the imagination; a weapon so ideally suited to sudden unannounced attack that a country's major cities might be destroyed overnight by an ostensibly friendly power. This weapon has been created not by the devilish inspiration of some warped genius but by the arduous labour of thousands of normal men and women working for the safety of their country. Many of the principles that have been used were well known to the international scientific world in 1940. To develop the necessary industrial processes from these principles has been costly in time, effort and money, but the processes which we [*i.e.*, America] selected for serious effort have worked and several that we have not chosen could probably be made to work. We have an initial advantage in time because, so far as we know, other countries have not been able to carry out parallel developments during the war period. We also have a general advantage in scientific and particularly in industrial strength, but such an advantage can easily be thrown away.

Before the surrender of Germany there was always a chance that German scientists and engineers might be developing atomic bombs which would be sufficiently effective to alter the course of the war. There was therefore no choice but to work on them in this country. Initially many scientists could, and did, hope that some principle would emerge which would prove that atomic bombs were inherently impossible. This hope has faded gradually; fortunately, in the same period, the magnitude of the necessary industrial effect has been demonstrated so that the fear of German success weakened even before the end came.

Future Development

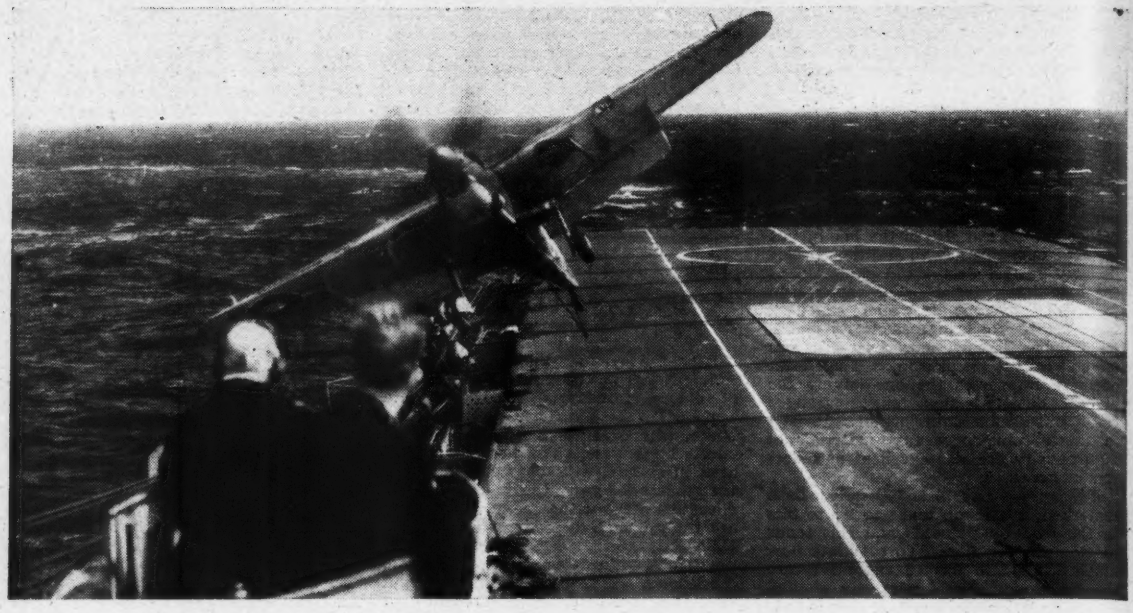
As to the future, one may guess that technical developments will take place along two lines. From the military point of view it is reasonably certain that there will be improvements both in the processes of producing fissionable material and in its use. It is conceivable that totally different methods may be discovered for converting matter into energy since it is to be remembered that the energy released in uranium fission corresponds to the utilisation of only about one-tenth of one per cent. of its mass. Should a scheme be devised for converting to energy even as much as a few per cent. of the matter of some common material, civilisation would have the means to commit suicide at will.

The possible uses of nuclear energy are not all destructive, and the second direction in which technical development can be expected is along the paths of peace.

While there is general agreement that a great industry might eventually arise comparable, perhaps, with the electronics industry, there is disagreement as to how rapidly such an industry will grow; the consensus is that the growth will be slow over a period of many years. At least there is no immediate prospect of running cars with nuclear power or lighting houses with radioactive lamps, although there is a good probability that nuclear power for special purposes could be developed within ten years, and that plentiful supplies of radioactive materials can have a profound effect on scientific research and perhaps on the treatment of certain diseases in a similar period.

The Questions Before the People.—We find ourselves with an explosive which is far from completely perfected. Yet the future possibilities of such explosives are appalling, and their effects on future wars and international affairs are of fundamental importance. Here is a new tool for mankind, a tool of unimaginable destructive power. Its development raises many questions that must be answered in the near future.

Because of the restrictions of military security there has been no chance for the Congress or the people to debate such questions. They have been seriously considered by all concerned and vigorously debated among the scientists, and the conclusions reached have been passed along to the higher authorities. These questions are not technical questions; they are political and social questions, and the answers given to them may affect all mankind for generations.



HANGING ON THE PROP: A narrow shave on H.M.S. *Vengeance* when the pilot of a Barracuda changed his mind about landing. He made a perfect landing the next time round.

SERVICE AVIATION

Royal Air Force and Naval Air Arm News and Announcements

R.A.F. Appointments

THE Air Ministry announces the following R.A.F. appointments:—

Air Vice-Marshal J. D. BREAKEY, C.B., D.F.C., to be Air Officer Commanding, A.H.Q., Malaya.

Air Vice-Marshal Sir B. E. EMBRY, K.B.E., C.B., D.S.O., D.F.C., A.F.C., to be Director General of Training, Air Ministry.

Air Vice-Marshal C. E. N. GUEST, C.B.E., to be Air Officer, Transport Command, South-East Asia.

Air Comdre. J. D. I. HARDMAN, C.B., O.B.E., D.F.C., Air Officer Commanding No. 232 Group, to be Air Vice-Marshal.

Air Vice-Marshal Breakey has been A.O.C., No. 222 Group, since September last. He was previously Assistant Chief of Air Staff (Technical Requirements) from April, 1943. Before that date he had been Director of Operational Requirements at the Air Ministry for two years.

Air Vice-Marshal Embry has been A.O.C. a Group in the 2nd T.A.F., later British Air Forces of Occupation, since June, 1943. He was previously S.A.S.O. of a Group in Fighter Command and S.A.S.O., Air H.Q., Western Desert. In 1941 he commanded R.A.F. Station, Wittering, and during the period of the Battle of Britain was leader of a fighter wing.

Air Vice-Marshal Guest has been A.O.C., No. 229 Group (India), since November, 1943, and was previously Deputy-Director of Organisation at the Air Ministry from September, 1942. Earlier in that year he was attached to Defence H.Q., South Africa, for special duty. From December, 1940, until February, 1942, he held various staff appointments in the Middle East.

Air Vice-Marshal Hardman has commanded No. 232 Group since February last, after three months as Deputy Air Commander of the R.A.F. Element of Air Command, South-East Asia. Before going to take up that appointment, he was Director of Military Co-operation at the Air Ministry, where he had previously served in the Directorate of Plans for a year. From the outbreak of war he was on the headquarters staff of the R.A.F. Component of the Field Force in France, and after the fall of France was on air staff operational duties with No. 22 Group, and on special liaison duty with the Army (Eastern Command).

N.A.A. Pay Increase

THE following rates of progressive pay for Air Fitters have been announced, with effect from September 10th, 1945:—

After 3 years' service, 4s. 3d. per day.
After 6 years' service, 4s. 8d. per day.

Awards

Royal Air Force

THE KING has been graciously pleased to approve the following awards in recognition of gallantry and devotion to duty in the execution of air operations:—

Distinguished Flying Cross

F/O. D. S. SYKES, R.A.F.V.R., No. 7 Sqn.
F/O. G. C. TAVERNER, R.A.F.V.R., No. 51 Sqn.
F/O. K. TEMPEST, R.A.F.V.R., No. 162 Sqn.
F/O. D. E. TILL, R.A.F.V.R., No. 576 Sqn.
F/O. R. de W TULLY, R.A.F.V.R., No. 75 (N.Z.) Sqn.
F/O. E. W. TURNBULL, R.A.F.V.R., No. 150 Sqn.
F/O. D. J. VARNEY, R.A.F., No. 35 Sqn.
F/O. N. L. WADE, R.A.F.V.R., No. 35 Sqn.
F/O. L. T. WALTON, R.A.F.V.R., No. 156 Sqn.
F/O. S. WHITCOMBE, R.A.F.V.R., No. 195 Sqn.
F/O. R. WHITE, R.A.F.V.R., No. 35 Sqn.
F/O. E. W. WILLEY, R.A.F.V.R., No. 433 (R.C.A.F.) Sqn.
F/O. J. H. WILLIS, R.A.F.V.R., No. 627 Sqn.
F/O. D. WILSON, R.A.F.V.R., No. 429 (R.C.A.F.) Sqn.
F/O. G. WILSON, R.A.F.V.R., No. 582 Sqn.
F/O. A. A. WISEMAN, R.A.F.V.R., No 199. Sqn.
F/O. J. R. WOLFE, R.A.F.V.R., No. 223 Sqn.
F/O. A. L. WOODHART, R.A.F.V.R., No. 101. Sqn.
F/O. J. B. WRIGHT, R.A.F.V.R., No. 650 Sqn.
F/O. L. C. YOUNG, R.A.F.V.R., No. 7 Sqn.
F/O. S. YULE, R.A.F.V.R., No. 156 Sqn.
Act. F/O. W. BONSALL, R.A.F.V.R., No. 166 Sqn.
Act. F/O. G. E. GILBERTS, R.A.F.V.R., No. 90 Sqn.

Air Vice-Marshal S. F. Vincent, C.B., D.F.C., A.F.C., Senior Air Staff Officer of Fighter Command.

Act. F/O. W. C. H. GOODY, R.A.F.V.R., No. 7 Sqn.
Act. F/O. W. S. HILL, R.A.F.V.R., No. 218 Sqn.
Act. F/O. C. I. HOPKINS, R.A.F.V.R., No. 195 Sqn.
Act. F/O. P. W. PLENDERLEITH, R.A.F.V.R., No. 44 Sqn.
P/O. H. F. AMY, R.A.F.V.R., No. 77 Sqn.
P/O. A. B. ANGER, R.A.F., No. 51 Sqn.
P/O. B. BLOMLEY, R.A.F.V.R., No. 7 Sqn.
P/O. R. W. BRITNELL, R.A.F.V.R., No. 7 Sqn.
P/O. J. M. BROOK, R.A.F.V.R., No. 7 Sqn.
P/O. D. McC. BUCHANAN, R.A.F.V.R., No. 150 Sqn.
P/O. F. J. BUNNELL, R.A.F.V.R., No. 10 Sqn.
P/O. K. A. BURNS, R.A.F.V.R., No. 9 Sqn.
P/O. R. E. CARLTON, R.A.F.V.R., No. 218 Sqn.
P/O. M. J. CARROLL, R.A.F.V.R., No. 158 Sqn.
P/O. J. A. DAVIES, R.A.F.V.R., No. 635 Sqn.
P/O. W. I. DAVIES, R.A.F.V.R., No. 156 Sqn.
P/O. H. A. DAVIS, R.A.F.V.R., No. 51 Sqn.
P/O. W. P. DODDS, R.A.F.V.R., No. 635 Sqn.
P/O. D. J. DOHERTY, R.A.F., No. 9 Sqn.
P/O. J. L. DUFFY, R.A.F.V.R., No. 582 Sqn.
P/O. J. B. DUTTON, R.A.F.V.R., No. 149 Sqn.
P/O. D. J. EARL, R.A.F.V.R., No. 10 Sqn.
P/O. A. W. A. ELLEY, R.A.F.V.R., No. 158 Sqn.
P/O. M. FELTZ, R.A.F.V.R., No. 10 Sqn.
P/O. E. T. FERBY, R.A.F.V.R., No. 142 Sqn.
P/O. K. H. FLYNN, R.A.F.V.R., No. 7 Sqn.
P/O. J. C. GARDNER, R.A.F.V.R., No. 51 Sqn.
P/O. W. V. GREATOREX, R.A.F.V.R., No. 223 Sqn.
P/O. W. J. C. GREEN, R.A.F.V.R., No. 142 Sqn.
P/O. A. B. HAMILTON, R.A.F.V.R., No. 10 Sqn.
P/O. K. W. E. HOUGHTON, R.A.F.V.R., No. 625 Sqn.
P/O. E. J. JENKINS, R.A.F.V.R., No. 166 Sqn.
P/O. R. T. JOUGHIN, R.A.F.V.R., No. 619 Sqn.
P/O. C. H. KNIGHT, R.A.F.V.R., No. 635 Sqn.
P/O. J. H. LATHAM, R.A.F.V.R., No. 460 (R.A.A.F.) Sqn.

SERVICE AVIATION

P/O. S. LAWS, R.A.F.V.R., No. 9 Sqn.
P/O. V. LEE, R.A.F.V.R., No. 90 Sqn.
P/O F. C. LOFTHOUSE, R.A.F.V.R., No. 51 Sqn.
P/O. R. S. MCNAY, R.A.F.V.R., No. 109 Sqn.
P/O. E. G. MEREDITH, D.F.M., R.A.F.V.R., No. 35 Sqn.
P/O. J. W. MOORE, R.A.F.V.R., No. 12 Sqn.
P/O. W. R. MORRIS, R.A.F.V.R., No. 218 Sqn.
P/O. G. E. MUCHMORE, R.A.F.V.R., No. 635 Sqn.
P/O. C. A. PENNY, R.A.F.V.R., No. 214 Sqn.
P/O. C. E. A. PHILLIPS, R.A.F.V.R., No. 7 Sqn.
P/O. H. R. PHILLIPS, R.A.F.V.R., No. 192 Sqn.
P/O. N. H. PRIOR, R.A.F.V.R., No. 128 Sqn.
P/O. W. R. RAINE, R.A.F.V.R., No. 15 Sqn.
P/O. R. D. RITCHIE, R.A.F., No. 166 Sqn.
P/O. J. RICHARDSON, R.A.F.V.R., No. 101 Sqn.
P/O. G. E. ROWE, R.A.F., No. 619 Sqn.
P/O. W. A. ROSE, R.A.F.V.R., No. 186 Sqn.
P/O. A. SHALLCROSS, R.A.F.V.R., No. 10 Sqn.
P/O. K. A. SMITH, R.A.F.V.R., No. 550 Sqn.
P/O. S. F. STOCKWELL, R.A.F.V.R., No. 692 Sqn.
P/O. E. C. TAYLOR, R.A.F.V.R., No. 571 Sqn.
P/O. D. THOMPSON, R.A.F.V.R., No. 7 Sqn.
P/O. E. THORNLEY, R.A.F.V.R., No. 7 Sqn.
P/O. P. A. UPSON, R.A.F.V.R., No. 186 Sqn.
P/O. P. A. H. VINEY, R.A.F.V.R., No. 625 Sqn.
P/O. H. E. WALTHEW, R.A.F.V.R., No. 635 Sqn.
P/O. J. H. WARD, R.A.F.V.R., No. 51 Sqn.
P/O. A. W. WELLER, R.A.F.V.R., No. 7 Sqn.
P/O. N. WESTBY, R.A.F.V.R., No. 35 Sqn.
W/O. J. FOGO, R.A.F.V.R., No. 163 Sqn.
W/O. A. C. FRASER, R.A.F.V.R., No. 223 Sqn.
W/O. K. R. GRAHAM (now P/O.), R.A.F.V.R., No. 149 Sqn.
W/O. S. GUYAN, R.A.F.V.R., No. 115 Sqn.
W/O. N. F. HARRIS, R.A.F.V.R., No. 156 Sqn.
W/O. T. H. HAYDAY, R.A.F.V.R., No. 622 Sqn.
W/O. W. R. HODGES, R.A.F.V.R., No. 582 Sqn.
W/O. A. JACKSON (now P/O.), R.A.F., No. 617 Sqn.
W/O. J. H. JENNINGS, D.F.M., R.A.F.V.R., No. 10 Sqn.
W/O. K. KEOGH (now P/O.), R.A.F.V.R., No. 7 Sqn.
W/O. H. J. LAZENBY, R.A.F., No. 7 Sqn.
W/O. R. H. MARSHALL, R.A.F.V.R., No. 7 Sqn.
W/O. J. A. MOORE, R.A.F.V.R., No. 35 Sqn.
W/O. A. R. NOTLEY, R.A.F.V.R., No. 7 Sqn.
W/O. R. W. PARSONS, R.A.F.V.R., No. 149 Sqn.
W/O. S. J. PAY, R.A.F.V.R., No. 186 Sqn.
W/O. R. A. POWELL, R.A.F.V.R., No. 75 (N.Z.) Sqn.
W/O. J. F. SMEATON, R.A.F.V.R., No. 90 Sqn.
W/O. H. SOMERVILLE, R.A.F.V.R., No. 115 Sqn.
W/O. R. W. A. WARD, R.A.F.V.R., No. 186 Sqn.
Flt. Lt. V. T. DAVIS, R.A.A.F., No. 160 Sqn.
Flt. Lt. D. H. TURNBULL, R.A.F.V.R., No. 240 Sqn.
F/O. K. A. RUTHERFORD, R.N.Z.A.F., No. 17 Sqn.
F/O. H. J. WEEDEN, R.C.A.F., No. 8 Sqn.
F/O. C. W. WHEELER, R.A.F.V.R., No. 99 Sqn.
F/O. H. J. FARQUHAR, R.A.F.V.R., No. 142 Sqn.
F/O. D. D. S. FERGUSON, R.A.F.V.R., No. 550 Sqn.
F/O. J. N. FERGUSON, R.A.F.V.R., No. 90 Sqn.
F/O. D. B. FRANCIS, R.A.F.V.R., No. 450 (R.A.A.F.) Sqn.
F/O. P. E. FREY, R.A.F.V.R., No. 171 Sqn.
F/O. R. N. GODWIN, R.A.F.V.R., No. 223 Sqn.
F/O. E. GOMERSALL, R.A.F.V.R., No. 192 Sqn.
F/O. C. F. GREEN, R.A.F.V.R., No. 75 (N.Z.) Sqn.
F/O. W. L. GREEN, R.A.F.V.R., No. 571 Sqn.
F/O. E. C. GRIMWOOD, R.A.F.V.R., No. 149 Sqn.
F/O. L. H. HANCOCK, R.A.F.V.R., No. 482 Sqn.
F/O. R. A. HANGER, R.A.F.V.R., No. 90 Sqn.
F/O. K. HANNEY, R.A.F.V.R., No. 101 Sqn.
F/O. R. A. J. HANSON, R.A.F.V.R., No. 185 Sqn.
F/O. G. J. HARVEY, R.A.F.V.R., No. 12 Sqn.
F/O. E. E. HESKETH, R.A.F.V.R., No. 10 Sqn.
F/O. J. M. HILL, R.A.F.V.R., No. 622 Sqn.
F/O. L. N. HILL, R.A.F.V.R., No. 146 Sqn.
F/O. A. J. W. HILLS, R.A.F.V.R., No. 622 Sqn.
F/O. C. H. HOUSDEN, R.A.F.V.R., No. 617 Sqn.
F/O. H. G. HOWELLS, R.A.F.V.R., No. 75 (N.Z.) Sqn.
F/O. F. B. JARMAN, R.A.F., No. 12 Sqn.
F/O. A. W. JENKINSON, R.A.F.V.R., No. 460 (R.A.A.F.) Sqn.
F/O. D. G. W. H. JONES, R.A.F.V.R., No. 75 (N.Z.) Sqn.
F/O. D. L. JONES, R.A.F.V.R., No. 153 Sqn.
F/O. A. L. KEELEY, R.A.F.V.R., No. 9 Sqn.
F/O. T. A. KING, R.A.F.V.R., No. 635 Sqn.
F/O. T. KITCHING, R.A.F.V.R., No. 153 Sqn.
F/O. S. R. KURTON, R.A.F.V.R., No. 7 Sqn.
F/O. A. J. D. LEACH, R.A.F.V.R., No. 12 Sqn.
F/O. T. W. LEDINGHAM, R.A.F.V.R., No. 514 Sqn.
F/O. J. B. LEWIS, R.A.F.V.R., No. 102 Sqn.
F/O. F. W. LOVICK, R.A.F., No. 192 Sqn.
F/O. J. B. LUARD, R.A.F.V.R., No. 635 Sqn.
F/O. R. A. MARRIOTT, R.A.F.V.R., No. 150 Sqn.
F/O. L. J. MARSHALL, R.A.F.V.R., No. 10 Sqn.
F/O. A. MCMILLAN, R.A.F.V.R., No. 223 Sqn.
F/O. J. MEADOWS, R.A.F.V.R., No. 10 Sqn.
F/O. G. E. MEARNS, R.A.F.V.R., No. 550 Sqn.
F/O. P. A. MEWLAND, R.A.F.V.R., No. 102 Sqn.
F/O. R. A. D. NEWMAN, R.A.F.V.R., No. 582 Sqn.
F/O. A. E. OBAM, R.A.F.V.R., No. 199 Sqn.
F/O. L. M. PAGE, R.A.F.V.R., No. 83 Sqn.
F/O. H. PAUL, R.A.F.V.R., No. 7 Sqn.
F/O. A. R. PERRIN, R.A.F.V.R., No. 7 Sqn.
F/O. G. A. REEVES, R.A.F.V.R., No. 7 Sqn.
F/O. J. J. REYNOLDS, R.A.F.V.R., No. 195 Sqn.
F/O. W. E. RICHARDSON, R.A.F.V.R., No. 195 Sqn.
F/O. R. E. ROBERTS, R.A.F.V.R., No. 115 Sqn.
F/O. S. N. ROWLEY, R.A.F.V.R., No. 138 Sqn.
F/O. G. G. RUNNALLS, R.A.F.V.R., No. 619 Sqn.
F/O. R. SILVER, R.A.F.V.R., No. 149 Sqn.
F/O. G. W. SHRIMPTON, R.A.F.V.R., No. 102 Sqn.
F/O. W. SNOW, R.A.F.V.R., No. 582 Sqn.
F/O. R. D. SOMMERVILLE, R.A.F.V.R., No. 75 (N.Z.) Sqn.
F/O. R. I. STEVENS, R.A.F.V.R., No. 156 Sqn.
F/O. C. H. STEELE, R.A.F.V.R., No. 582 Sqn.
F/O N. H. STIMSON, R.A.F.V.R., No. 625 Sqn.
F/O. M. W. STOTT, R.A.F.V.R., No. 158 Sqn.
Wing Cdr. R. C. CRAWFORD, R.A.F., No. 194 Sqn. (with effect from June 19th, 1945), (since deceased).
Act. Sqn. Ldr. P. G. BELL, R.A.F.V.R., No. 62 Sqn.
Act. Sqn. Ldr. C. R. HARROD, R.A.F.V.R., No. 212 Sqn.
Act. Sqn. Ldr. L. C. MCCONNELL, R.A.F.V.R., No. 358 Sqn.
Flt. Lt. R. L. ANDREWS, R.A.F.V.R., No. 151 Sqn.
Flt. Lt. E. R. W. ARIS, R.A.F., No. 123 Sqn.
Flt. Lt. H. A. AYKROYD, R.A.F.V.R., No. 45 Sqn.
Flt. Lt. J. L. BRIGGS, R.A.F.V.R., No. 607 Sqn.
Flt. Lt. S. G. BURGESS, R.A.F.V.R., No. 34 Sqn.
Flt. Lt. G. B. COOPER, R.A.F.V.R., No. 99 Sqn.
Flt. Lt. J. T. CRAIG, R.A.F.V.R., No. 267 Sqn.

(Left) Badge of No. 738 Squadron, Naval Air Arm—"Parave Bellum" (Prepare for War). On a blue field, a foul anchor, erect gold, in front of a ray of lightning in bend white, the whole surmounted by a Pegasus courant also white. (Right) Badge of No. 809 Squadron, Naval Air Arm—"Immortal." On a blue field, a Phœnix, gold, rising from flames, proper.

Flt. Lt. C. H. EGERTON-EVES, R.A.F.V.R., No. 357 Sqn.
Flt. Lt. D. T. GRAHAM, R.A.F.V.R., No. 62 Sqn.
Flt. Lt. M. J. GRIFFITHS, R.A.F.V.R., No. 267 Sqn.
Flt. Lt. A. T. GRUBB, R.A.F.V.R., No. 123 Sqn.
Flt. Lt. D. S. HERD, R.A.F.V.R., No. 575 Sqn.
Flt. Lt. H. D. JOHNSON, R.A.F.V.R., No. 91 Sqn.
Flt. Lt. L. A. LIKEMAN, R.A.F.V.R., No. 194 Sqn.
Flt. Lt. A. MACKENZIE, R.A.F.V.R., No. 267 Sqn.
Flt. Lt. A. C. MCLEAN, R.A.F.V.R., No. 159 Sqn.
Flt. Lt. J. S. MITCHELL, R.A.F.V.R., No. 211 Sqn.
Flt. Lt. R. K. PARRY, R.A.F.V.R., No. 607 Sqn.
Flt. Lt. D. A. PIDGEON, R.A.F.V.R., No. 607 Sqn.
Flt. Lt. H. RICHARDSON, R.A.F.V.R., No. 159 Sqn.
Flt. Lt. A. R. SAINT, R.A.F.V.R., No. 267 Sqn.
Flt. Lt. G. E. V. TOWNSEND, R.A.F.V.R., No. 99 Sqn.
Flt. Lt. N. G. TOWNSEND, R.A.F.V.R., No. 99 Sqn.
Flt. Lt. J. E. T. YENDALL, R.A.F.V.R., No. 52 Sqn.
Act. Flt. Lt. J. R. MUIR, R.A.F.V.R., No. 249 Sqn. (with effect from February 28th, 1945) (since deceased).
F/O. N. G. ALDERDICE, R.A.F.V.R., No. 123 Sqn.
F/O. K. A. AYRES, R.A.F.V.R., No. 153 Sqn. (with effect from March 11th, 1945) (since deceased).
F/O. F. BARRETT, R.A.F.V.R., No. 159 Sqn.
F/O. R. S. P. BARRATT, R.A.F.V.R., No. 267 Sqn.
F/O. C. C. BERRY, R.A.F., No. 240 Sqn.
F/O. N. A. BOLITHO, R.A.F.V.R., No. 177 Sqn.
F/O. E. R. DICKETTS, R.A.F.V.R., No. 194 Sqn.
F/O. J. S. C. FRANCIS, R.A.F.V.R., No. 267 Sqn.
W/O. R. J. WICKS, R.A.F.V.R., No. 109 Sqn.
W/O. H. WINN, R.A.F.V.R., No. 75 (N.Z.) Sqn.

Distinguished Flying Medal

Flt. Sgt. F. H. KEMPIN, R.A.F.V.R., No. 186 Sqn.
Flt. Sgt. J. K. KERSHAW, R.A.F.V.R., No. 35 Sqn.
Flt. Sgt. P. J. LEEVES, R.A.F.V.R., No. 35 Sqn.
Flt Sgt. R S. LIVERSEDGE, R.A.F.V.R., No. 9 Sqn.

Foreign Decorations

THE KING has granted unrestricted permission for the wearing of the undermentioned decorations conferred upon the personnel indicated, in recognition of valuable services rendered in connection with the war:—

Conferred by the President of the United States of America

Legion of Merit (Commander)

Air Vice-Marshal G. B. A. BAKER, C.B., C.B.E., M.C., R.A.F.

Legion of Merit (Officer)

Air Comdre. T. G. PIKE, C.B.E., D.F.C., R.A.F.

Bronze Star Medal

Wing Cdr. P. W. BINGHAM, R.A.F.
Wing Cdr. T. D. CRAVEN, R.A.F.
Wing Cdr. R. J. LE GRAND, R.A.F.V.R.
Wing Cdr. W. MCARTHUR, R.A.F.
Act. Wing Cdr. C. HEARD-WHITE, M.B.E., R.A.F.V.R.
Sqn. Ldr. P. A. B. BRANWELL, R.A.F.
Sqn. Ldr. A. JENNINGS, R.A.F.V.R.
Sqn. Ldr. W. MCADAM, R.A.F.V.R.
Sqn. Ldr. M. G. WILLS, R.A.F.V.R.
Act. Sqn. Ldr. C. MERRICK, D.F.C., R.A.F.V.R.
Act. Sqn. Ldr. G. F. OLIVER, R.A.F.
Flt. Lt. F. J. DAVIES, R.A.F.V.R.
Flt. Lt. C. S. HOW, R.A.F.V.R.
Sgt. G. HENDERSON, R.A.F.V.R.

VERTICALLY OPPOSED: This picture shows a new method of carrying eight rocket projectiles—above and below on four rails. The aircraft is a Desert Air Force Mustang.

SERVICE AVIATION

Conferred by Her Majesty the Queen of the Netherlands

Flying Cross

Sqn. Ldr. R. E. WILKINSON, D.F.C., R.A.F.V.R. (since deceased).

Flt. Lt. A. J. DE L. RUTTLEDGE, D.F.C., R.C.A.F.

Roll of Honour

Casualty Communiqué No. 549.

THE Air Ministry regrets to announce the following casualties on various dates. The next of kin have been informed. Casualties "in action" are due to flying operations against the enemy; "on active service" includes ground casualties due to enemy action, non-operational flying casualties, fatal accidents and natural deaths.

Of the names in this list, 194 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—F/O. A. E. Adams; Sgt. G. E. Arthur; P/O. S. H. Blower; Flt. Sgt. E. Brierley; Flt. Sgt. J. J. Brophy; Sgt. J. T. Buckley; Flt. Lt. N. G. Butler; Flt. Sgt. W. G. Carr; Flt. Lt. J. T. Edmonds; F/O. A. Farrow; Flt. Sgt. A. G. R. MacKenzie; Act. Flt. Lt. T. A. O'Halloran; Flt. Sgt. J. A. H. G. Pennant; Flt. Sgt. F. A. Relfe; Flt. Sgt. F. Robson; Sgt. D. L. Rogers; Flt. Lt. R. Rootes; F/O. A. S. B. Rushton; Sgt. E. Sheavills; Sgt. J. Staines; Flt. Lt. D. J. Stalker; F/O. R. T. Styles; Flt. Sgt. P. Thompson.

MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Flt. Lt. E. G. Hutchin; F/O. A. Latham; Flt. Lt. V. S. Robbins.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. M. Convy; Sgt. J. Truby.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ACTION.—Flt. Sgt. C. H. Abram; W/O. R. B. Aitken; Sgt. K. H. Allaker; Sgt. J. T. Ash; P/O. C. R. H. Baker; Act. Flt. Lt. R. J. L. Banks; Flt. Sgt. N. E. J. Barnes; Sgt. K. G. Barnett; Flt. Sgt. S. J. Barr; F/O. C. Beatson; F/O. B. E. Bell; Sgt. J. A. W. Bodsworth; Sgt. C. A. Bonner; P/O. H. J. Bonnett; Act. F/O. W. D. Brickwood; Sgt. A. H. Brown; Flt. Sgt. F. Burgess; Flt. Sgt. W. McG. H. Burnett; W/O. J. W. Butterworth; Sgt. A. G. Buttling; Act. F/O. D. Campbell; Sgt. F. Cartwright; F/O. C. D. Chirighin; F/O. H. D. Clark; Sgt. J. T. Cockburn; Sgt. L. W. Cudlipp; Sgt. F. H. Davidson; Flt. Sgt. A. Davison; Flt. Sgt. F. G. Dean; Sgt. J. F. Dineen; Sgt. R. K. Dove; F/O. P. T. Driscoll; Sgt. R. A. Drury; Sgt. W. Duncan; P/O. H. Easthope; P/O. I. P. Edwards; Sgt. L. C. Ekers; Sgt. E. E. Evans; Sgt. J. G. F. Evans; Flt. Sgt. H. A. S. Filmer; Flt. Lt. J. Fotheringham-Parker; Sgt. R. Furlong; Sgt. R. P. Gatensbury; P/O. T. Gilchrist; Sgt. E. G. Gilliatt; Flt. Sgt. J. Gilray; Sgt. F. V. Gott; Flt. Sgt. A. W. Gowdey; Sgt. J. Gregory; Sgt. T. Gribbon; F/O. C. J. Griffith; F/O. F. C. H. Gunn; F/O. D. W. Guttridge; Flt. Sgt. F. R. Harmsworth-Smith; Sgt. D. Harrison; Sgt. D. H. Hedley; Flt. Sgt. J. Henderson; Flt. Lt. R. J. Hewett, D.F.M.; Sgt. J. Holden; Flt. Sgt. F. R. Holledge; Flt. Sgt. T. Horrocks; Sgt. H. R. S. Hunnisett; Flt. Sgt. T. E. Jenkins; Sgt. M. A. Johnson; Sgt. F. T. E. Jones; Flt. Sgt. R. R. Jones; P/O. R. C. M. Jones; Sgt. D. Judson; Sgt. H. R. Knight; P/O. J. E. Lott; Sgt. J. McCool; Flt. Lt. G. Mains; P/O. D. Mapleson; F/O. L. F. A. Marston; F/O. N. A. Marston, D.F.C.; Sgt. F. Meade; Sgt. J. Melville; Flt. Sgt. W. J. Mintjens; F/O. R. E. Monk; F/O. J. Morrison; Sgt. D. R. Muxlow; Sgt. K. E. Nottage; W/O. R. Pedrazzini; F/O. L. W. Petts; F/O. A. V. Philp; P/O. A. D. Price; Flt. Sgt. L. W. Pullee; P/O. R. B. Pullin; Sgt. J. J. Reed; Flt. Sgt. N. P. Reilly; Sgt. K. J. Roberts; Flt. Sgt. J. W. Robinson; Flt. Sgt. W. Ross; Sgt. A. W. Ryder; P/O. A. C. Scott; Sgt. H. D. Scott; Act. Flt. Lt. A. L. Silverman; P/O. J. A. Simcox; Sgt. R. G. V. Simpson; Flt. Sgt. J. A. Spence; Sgt. P. Standley-Smith; Sgt. A. Stephen; P/O. A. H. Stewart; Act. Flt. Lt. R. V. Stoneman; Sgt. C. W. Taylor; F/O. R. Toomer; Sgt. A. V. Urquhart; Sgt. W. Wallinger; Flt. Sgt. D. H. Watts; Flt. Sgt. F. S. Webb; P/O. R. Whalley; Act. F/O. G. G. Whyte; P/O. A. Williams; Flt. Sgt. L. E. Williams; Sgt. W. F. Williams; Flt. Sgt. N. A. Wilson; F/O. P. A. Wilson; F/O. E. Wright; F/O. G. H. Wyand.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—Sgt. F. R. Arnold; Sgt. D. J. E. Fontaine; Sgt. P. A. Gilliatt; Sgt. H. Hamilton; Sgt. E. Nicholson; Sgt. J. Smith.

WOUNDED OR INJURED IN ACTION.—Sgt. M. J. Hyett; Flt. Sgt. W. C. Williams.

MISSING, BELIEVED KILLED IN ACTION.—Act. Wing Cdr. R. E. Bary, D.F.C.; Sgt. L. G. Clarke; F/O. R. F. Harrison; P/O. D. Hugo; Sgt. P. A. Neale; Flt. Lt. E. W. Newman; F/O. N. E. Passey; Sgt. J. J. R. Raybould; F/O. T. D. M. Ross; Sgt. I. T. Walker; Flt. Sgt. R. C. Winchester.

MISSING.—Flt. Lt. J. E. Bennett, D.F.C.; Sgt. J. L. Buxton; Flt. Sgt. W. Campey; Flt. Sgt. H. W. Ellis; Flt. Lt. J. D. Evans; Sgt. J. R. Gee; Sgt. M. J. Gillane; Sgt. A. G. Gillon; F/O. S. C. Haralambides; Flt. Sgt. R. F. Harrison; Sgt. I. J. Hendry; Sgt. A. Hogg; Flt. Sgt. A. W. Howard; Flt. Sgt. W. K. Jacques; F/O. I. C. Jenkins; Flt. Sgt. K. Jeynes; Flt. Sgt. G. W. Lauder; Flt. Sgt. P. J. Lewis; Sgt. F. G. Lister; F/O. S. A. Lytle; Flt. Sgt. C. E. Marchant; Flt. Sgt. H. Minns; Flt. Sgt. R. V. Moore; Flt. Lt. K. J. Newman; Flt. Lt. C. W. Oxborrow; Act. Sqn. Ldr. E. G. Pannell; Flt. Sgt. A. W. Patterson; W/O. A. G. W. Payne; Sgt. S. G. Perrett; W/O. J. W. Preston; Sgt. R. W. Reid; Flt. Sgt. T. P. Roberts; Flt. Sgt. E. N. Rowland; P/O. H. J. Ryan; F/O. J. W. Scott; F/O. H. A. Smith; P/O. H. A. Stapleton; Sgt. S. Thomas; Flt. Sgt. J. Uhar; F/O. R. S. H. Wadham; Flt. Lt. E. V. Warwick; Flt. Lt. N. W. Wraight.

KILLED ON ACTIVE SERVICE.—W/O. H. Balmain; Sgt. J. J. Carswell; A/C.2 A. J. Corney; Flt. Sgt. R. B. Fowler; W/O. A. Gow; Sgt. A. O. Green; Flt. Sgt. W. Saul; P/O. P. G. Turner; W/O. D. G. Williams.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—L.A/C. J. Anderson; L.A/C. J. C. Brooks; A/C.2 H. Highton; L.A/C. E. H. Lascelles; A/C.1 J. R. Swann; Act. Flt. Lt A. J. Tisshaw.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Flt. Sgt. J. B. Greenwood; Sgt. F. Haley; Sgt. J. G. R. Smale.

WOUNDED OR INJURED ON ACTIVE SERVICE.—L.A/C. P. J. O'Connor; Cpl. K. J. Pavelin; Cpl. F. G. S. Sims.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Cpl. R. Bibby.

DIED ON ACTIVE SERVICE.—Sgt. R. Clarke; Sgt. G. K. Campbell; A/C.1 J. Daly; Flt. Sgt. R. S. Drongeson; Cpl. J. B. Ellery; L.A/C. S. T. Hadley; Air Comdre S. H. Hardy; F/O. W. H. Harris; Sgt. W. S. J. Hickmore; L.A/C. A. E. J. M. Hitchens; L.A/C. A. Laird; Cpl. J. S. Morgan; L.A/C. R. J. Parsons; Flt. Sgt. P. Purkiss; L.A/C. P. A Reel; L.A/C. K. E. Richards; Flt. Sgt. R. W. Robinson; L.A/C. R. Solt; Sgt. S. Welburn; Cpl A. D. White.

Women's Auxiliary Air Force

DIED ON ACTIVE SERVICE.—Cpl. H. P. Carlisle; L.A/CW. J. Mullin; .A/CW. M. Nicholson.

Royal Australian Air Force

KILLED IN ACTION.—F/O. P. D. Allan; Flt. Sgt. A. E. Bowman; Flt. Sgt. H. E. Burton; F/O. W. Forrester; Flt. Sgt. F. J. Howlett; F/O. R. Martin; F/O. O. R. Richardson.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—F/O. E. F. Collaery; Act. F/O. K. Grose; Flt. Sgt. G. J. Howard; Flt. Sgt. W. A. Roach; Flt. Lt. H. L. Smith; Flt. Sgt. G. A. B. Taverner; F/O. F. O. Williams; Act. Flt. Lt. J L. Wilson.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—P/O. D. R. Abell; Flt. Lt. J. C. Barlow; P/O. C. A. Black; Flt. Sgt. R. J. Bolton; Flt. Sgt. G. Caveridge; Flt. Sgt. J. R. Charley; Flt. Sgt. B. F. Cody; P/O. H. S. Delacour; Flt. Lt. W. J. Esler; W/O. C. Faust; P/O. W. W. Furse; P/O. D. Hislop; Flt. Sgt. A. D. Johnston; Flt. Sgt. T. S. Jones; W/O. F. J. Keegan; Flt. Sgt. A. Lord; Flt. Sgt. H. McRostie; Act. F/O. R. J. Miller; Flt. Sgt. A. R. Moller; P/O. H. M. Nottle; P/O. C. A. Peak; W/O. F. McL. Percy; Flt. Sgt. A. W. Poyzer; Flt. Sgt. D. M. R. Purdue; Act. Flt. Lt. R. L. Purry; Flt. Sgt. I. D. Stuart; F/O. D. E. Tolley; F/O. J. F. Tucker; W/O. J. A. Upton; Flt. Sgt. T. C. White; W/O. J. E. Williamson; Flt. Sgt. M. K. H. Wilson.

MISSING.—F/O. H. T. Evans; Flt. Lt. R. C. Halkyard; Flt. Lt. B. C. McKenzie; F/O. W. C. Milligan; F/O. K. W. Milne.

KILLED ON ACTIVE SERVICE.—P/O. R. J. Mirow; F/O. W. C. Russell

(Left) Badge of No. 886 Squadron, Naval Air Arm—"Vires Acquirit Eundo" (It gains Strength as it Goes). On a white field a Chinese dragon, green. (Right) Badge of No. 899 Squadron, Naval Air Arm—"Strike and Defend." On a blue field upon water barry wavy in base white and blue, a winged gauntlet proper. In chief five clouds, white.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Flt. Sgt. J. T. Andrew; Flt. Sgt. M. M. Roberts.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—F/O. D. V. Black; Flt. Sgt. J. I. Gamble; F/O. D. G. Ledsam.

DIED ON ACTIVE SERVICE.—L.A/C. A. J. Paddon.

Royal Canadian Air Force

KILLED IN ACTION.—Flt. Lt. E. G. Aitcheson; Flt. Lt. G. A. Barker; Flt. Lt. G. K. Graham; W/O. E. L. Luxton; F/O. S. E. Messum.

MISSING, BELIEVED KILLED IN ACTION.—P/O. T. A. McBeath.

MISSING.—P/O. E. K. Coyne; W/O. I. J. Kinney; P/O. J. Mcllrath; Flt. Sgt. J. Rabiner; W/O. K. L. Roth.

Royal New Zealand Air Force

KILLED IN ACTION.—F/O. R. A. Bamford; Flt. Lt. B. H. Webb.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—F/O. K. Southward.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—P/O. R. G. Collender; Flt. Sgt. P. J. Cook; Act. Flt. Lt. S. F. Fauvel; Act. F/O. L. Fulker, D.F.C.; Flt. Lt. L. E. Hale; F/O. F. H. C. Lukey; Flt. Sgt. J. M. T. McKenzie; lt. Sgt. J. R. Mason; P/O. G. R. Newey; F/O. S. Phillips; Flt. Sgt. K. V. Stafford.

MISSING.—F/O. L. Barnes; F/O. B. F. Scott.

KILLED ON ACTIVE SERVICE.—W/O. H. W. Webster.

South African Air Force

KILLED IN ACTION.—Capt. J. C. Coetzee, D.F.C.; Lt. G. F. McCormick; Lt. E. N. Roberts.

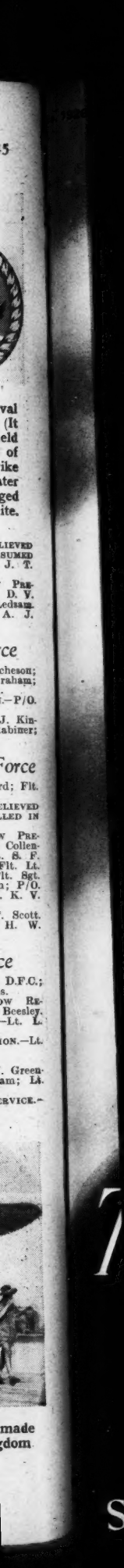
PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—Sgt. T. A. Beesley.

WOUNDED OR INJURED IN ACTION.—Lt. L. Jandrell.

MISSING, BELIEVED KILLED IN ACTION.—Lt. R. S. Wingfield.

MISSING.—Lt. M. Overed.

KILLED ON ACTIVE SERVICE.—Lt. H. N. Greenberg; Cpl. T. Griffiths; Lt. L. C. Loram; Lt. A. F. Smith.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Capt. R. B. Morton.

A CLEAN SWEEP of the runway is provided by Indians with home-made brooms, before this Transport Command Stirling takes off for the United Kingdom